

THE BUZZ ABOUT BATTERIES AND A FAST LOOK AT SPEED CONTROLLERS

BATTLEBOTS®

SPRING 2002: VOL II

MAGAZINE

CHAMPIONS OF THE NUT WINTER 2001

Action Photos and Team Profiles

MAKING THE TEAM

A Close-Up on the Builders in Team Loki

New Mexico State University's
Flying Bot Prototype

History of the KillSaws

The Ultimate BattleBox Weapon

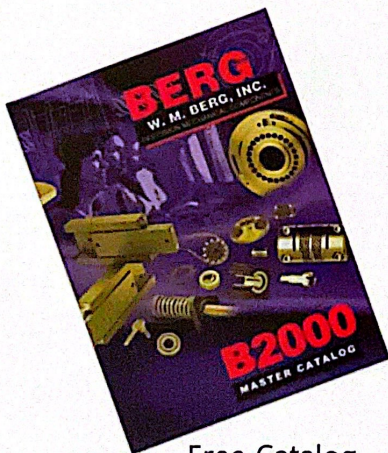
Plus:

Full Page Action Shots
Mark Beiro - BattleBots Announcer
BattleBox Improvements



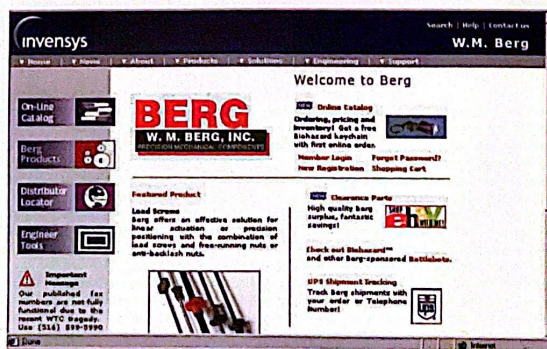


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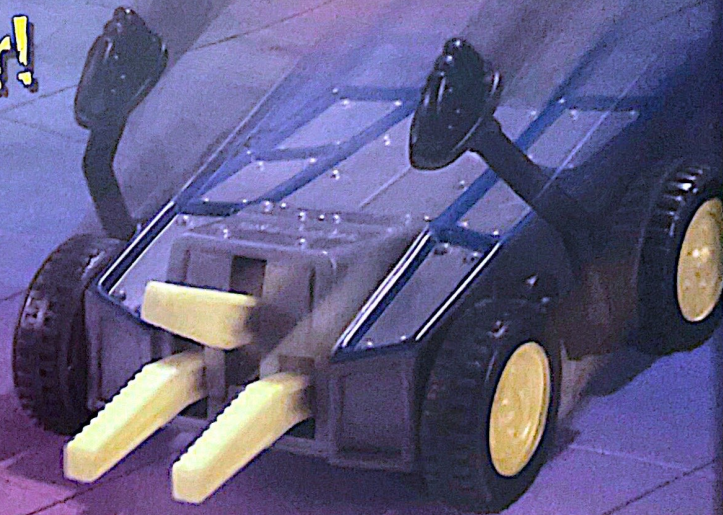


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On the Cover. Heavyweight contenders Greenspan (top) and Overkill (bottom) jockey for position while attempting to avoid the BattleBox KillSaws. Steven Brown, Team Brown's Commander, bludgeoned his 20th ranked multi-hammer robot relentlessly against the razor steel blade of Overkill. The 4th ranked Overkill slashed and bashed Greenspan into shrapnel, but was then outclassed by eventual Heavyweight champion BioHazard.

- Photo by Daniel Longmire

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BattleBots Magazine Spring 2002

Super Heavyweight Showdown:
Techno Destructo (right) and Ogre (left) stand toe to toe and exchange Super Heavyweight blows atop the BattleBox KillSaws. Techno Destructo pushes onward at the command of Sean Irvin. Tom Griffin's 17th ranked BattleBot Ogre was tough enough to go the distance against Techno Destructo, only to find itself short on points at the Judges table. Techno Destructo's powerful lifting arm won this match and managed to achieve an impressive ranking of #8 in the sport of BattleBots.

-Photo by Daniel Longmire





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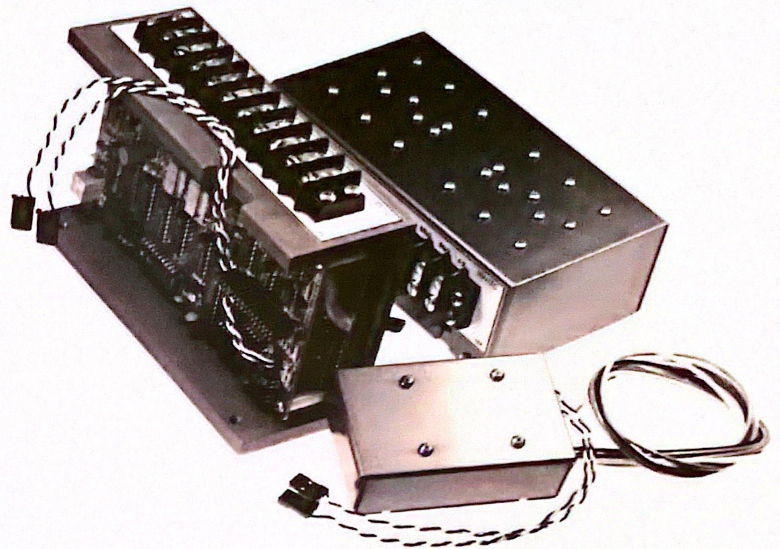
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Most corporations spend vast dollar amounts on marketing research. Market researchers, in some cases, investigate the television habits of the viewing public. These researchers exhaust countless hours on select groups of individuals that represent a desired target

market. At the end of the day a summary is drawn from the raw data that has been collected. This summary, through the eyes of the aforementioned, unknown researcher, reflects typical wants and needs of the general viewing public, that being you and me... Like it or not, the reality of this marketing system leads to a lack of progress in the development of modern American culture. We watch what they give us. We recycle that which we are exposed to. Television marketers question audiences who react to what they're watching, but what we watch has already been marketed. It's all very

**BATTLEBOTS
MAGAZINE
Creator
and
Editor
Roy F. Hellen Jr.**

confusing, and leads to a marketing loop, a house of mirrors, that repeats the same image, same story, same protagonist, over and over again.

BattleBots, on the other hand, is in a constant struggle to dispel any association with this recycled marketing phenomenon. BattleBots, ironically, is using Television to gain popularity as a sport instead of the sport being a construct of the research marketers to draw viewers. Marketers are starting to latch onto the concept. During the Super Bowl a commercial parody of BattleBots aired in a prime advertising spot. The term BattleBots is becoming more and more prevalent in every day speech. I hear the term

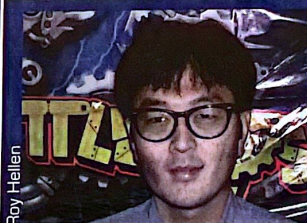
on buses, the street corner, on the radio, the subway; it's everywhere. People are talking. Although BattleBots has the circus lights of a game show, there is a definite undertone to legitimize the sport. Comedy Central has generously provided a platform from which the sport of robotic combat has grown. In the future I see larger and larger BattleBots venues. Over time BattleBots will make efforts to legitimize itself as a professionally structured sports program. The people are taking. We're listening. BattleBots is growing.

*The Box is Locked !
The Lights are On !
Its Robot Fightn' Time !*

The BattleBox

BattleBots, Inc. is introducing the newest BattleBox upgrades and improvements to ensure maximum safety.

On the roof, quarter inch Lexan supported by aluminum trusses, has been installed. This further encapsulates the top of the box, preventing any debris from flying out into the audience. The BattleBox floor has also been upgraded with quarter inch steel to prevent warping. BattleBots has removed the pistons and hell raisers to encourage more robot on robot contact. The KillSaws are now equipped with patented IKS BattleBot KillSaw Blades, available through the SYSTI MATIC catalogue.



**Young Ihm
Public Relations Director
Literary Editor
BattleBots Inc.**

In 2002, BattleBots will be venturing into new territory with the launch of the BattleBots IQ Program. This visionary project first involves the implementation of the BattleBots IQ Curriculum, an exciting robotics engineering course for high school students. The BattleBots IQ Tournament, the new interscholastic robotics competition, will then serve as the setting for the students to test their learned skills.

As the various professional robotics leagues continue to grow, we are likely to see practical applications for the sport in the areas of the aerospace,

manufacturing, and healthcare industries. However, BattleBots, Inc. has always believed that BattleBots IQ is the logical next step for the sport of robotics. Education is really the key to furthering the field of robotics. By appealing to middle and high school students, BattleBots IQ seeks to generate heightened interest in the math, science, and engineering disciplines. The objective is to create the highly recruitable engineers and scientists of the future. The fostering of scientific-minded graduates is a fundamental attribute of the BattleBots IQ program.

Another mission of BattleBots IQ is the formulation of a totally new interscholastic team sport which will showcase the

competitive potential of engineering and the industrial arts. The innovative result will be the creation of the "engineering student athlete."

The BattleBots IQ Curriculum is already being implemented in high schools across the United States and Canada. The first ever BattleBots IQ Tournament, held in March 2002 at Universal Studios in Orlando, Florida, provided the first real application of the IQ curriculum in the context of interscholastic sports. BattleBots, Inc. has plans for a children's educational television program that will showcase the entire BattleBots IQ learning experience. It will be an exciting new day for youth robotics education.



CrewBots Matt Earnhardt and Wayne Rayburn fasten down the BattleBox roof. The new 1/4 lexan roof was an important upgrade in the last shrapnel filled tournament.



Under the command of Peter Lambertson the CrewBots unload and assemble the BattleBox with undaunted precession and accuracy.

Mark Beiro Announces a New Sport

Ybor, pronounced EEE-boar, is a small historic Latin-American section of Tampa, Florida, where they specialize in tourism and the spawning of world-renowned robot announcers. As a small child growing up in West Tampa, Mark Beiro spent countless hours listening to old radio shows and mimicking the voices he heard through the crackling speakers. At the tender age of nine, Mark cast his first words over an amplified Public Address System. As the echoes of his voice bounced throughout the auditorium, Mark could hear his true calling. Today, as a successful announcer, Mark feels that he is living out his "American Dream."

A tuxedo clad figure, sporting patent snakeskin shoes, stands tall in the haze of the BattleBox wasteland. Seemingly oblivious to the shattered debris and oil stains, Mark announces the bouts with the mellifluous elegance of an Ian Fleming character. The BattleBox is a place where Mark feels at home. "No one gave me instructions on how to be a Robot Announcer, so I carried over what I knew from boxing." For Mark, the transition from Boxers to Robot Briefs was as seamless as his delivery.

Using his background as a Boxing Announcer, Mark is able to bring an air of credibility and professionalism to the sport of BattleBots. The fight introductions have been labeled by some as corny. Mark handles this deftly by assuming the style of Adam West's Batman character. Like Batman before him, Mark delivers bad jokes in the most serious fashion possible. "In my serious delivery of a bad joke, people will find the humor." That has turned out to be the case. Although Mark does not write the clever little robot openings, most agree that the introductions fit his jovial personality to a tee.

Mark feels the most important aspect of his job is to give the robots some human qualities. The object is to introduce the

robots as "Human Aliens" who are about to engage in metallic carnage for the viewing pleasure of millions. Mark willingly admits that he has very little technical savvy. The job of the BattleBox announcer is to give the audience the opportunity to identify with a certain contestant or builder over the course of the unrelenting metal mayhem.

Gage Cauchois' creation, Vlad The Impaler, was forced into early retirement last year after a severe mauling at the hands of Mechavore. At the time, Vlad was Mark's favorite robot. Mark admits that he must remain detached and impartial in order to do his job properly. That is not always easy in a sport where the contestants are so lovable and charismatic.

Through the last four decades, Mark has been the voice of Florida Jai Alai, EPSN Boxing, and News Radio WFLA 970 (Sundays 7pm-10pm). The BattleBots Tournament is very different from any other sport Mark has participated in before. "I have never seen this kind of camaraderie in a sport. The true spirit of American ingenuity is evident in the way the builders help and support each other through sportsmanship - to me it's unbelievable." Mark also hails the fans of BattleBots as the "nicest, kindest, most generous.... people I have ever had the honor to stand in front of." When Mark himself is introduced at the start of a tournament, the crowds give him a standing ovation. Mark is usually surprised by this and looks around to see what the commotion is all about. When he realizes that the adulation is for him, he just gives a sheepish grin and marches proudly into the BattleBox.



Daniel Longmire

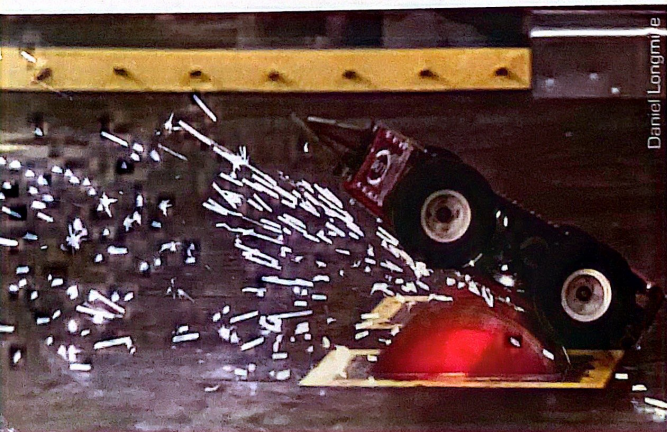
Mark Beiro Your Hero

2925 JACK RABBIT

Jack Rabbit, a Team Brown creation, uses two (2) MagMotors, four (4) 24V Battle Packs, and a Vantec 38E Speed Controller. This heavily armored Bot speared its way

through the preliminary bouts at top speeds of up to 30 mph. In its first ever tournament, Jack Rabbit was able to take down 5 opponents, achieving a #16 Middleweight

ranking. T.J. Brown (age 10) explains that the robot is extremely difficult to control. With enough practice however, T.J. has gotten very good at driving his creation. At the end of a very good tournament run, Jack Rabbit fought bravely against the veteran Huggy Bear, only to go down in defeat. Although the luck of the rabbit's foot ran out this time, expect Team Brown to be back for more at the next BattleBots Tournament.



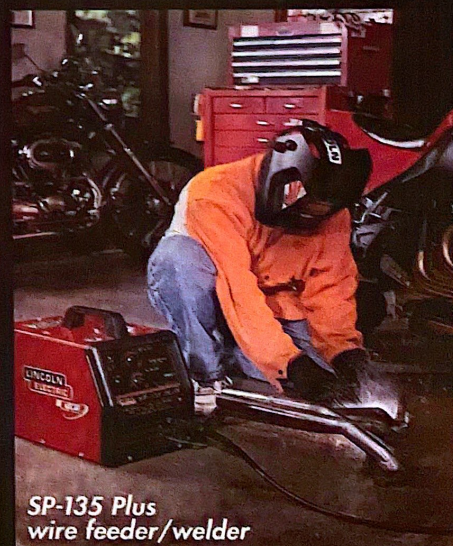
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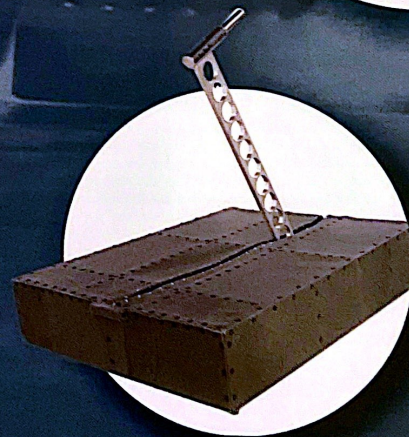
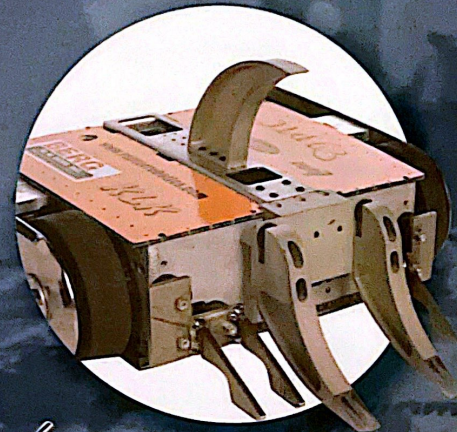
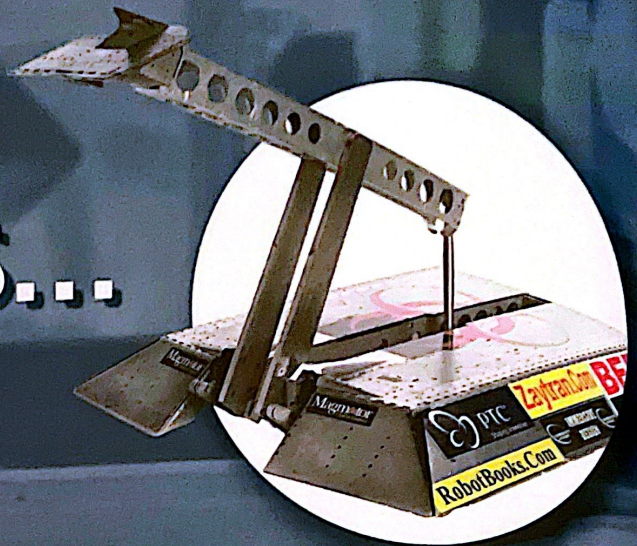
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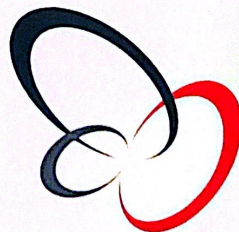
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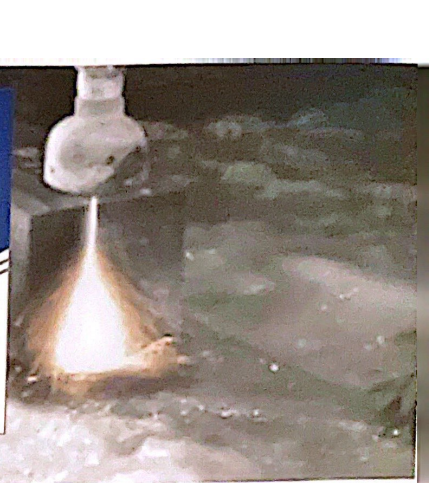
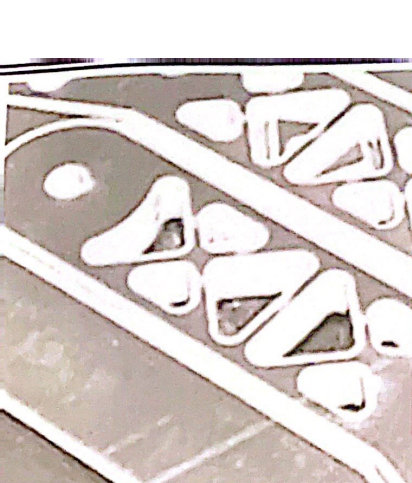
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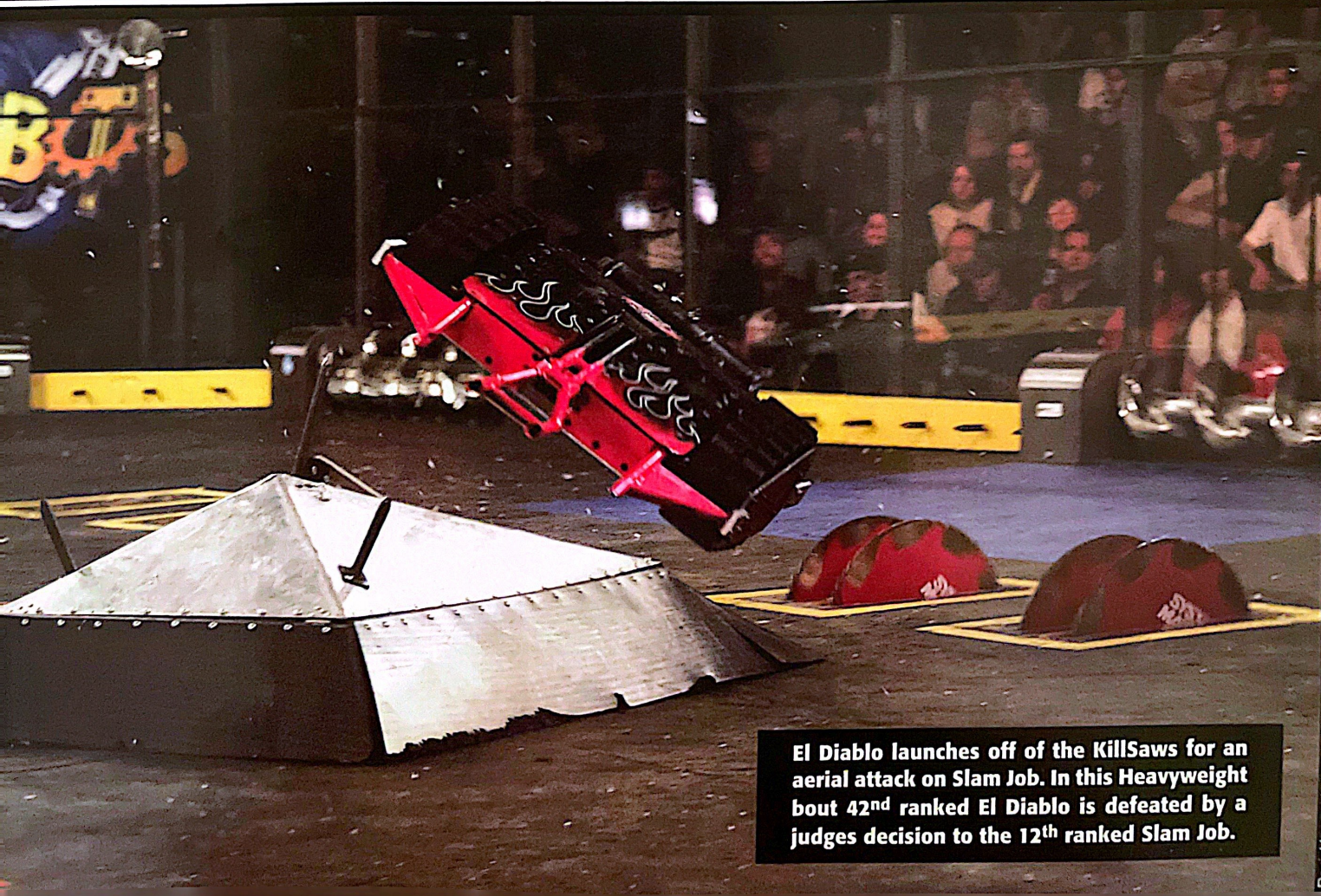
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El Diablo launches off of the KillSaws for an aerial attack on Slam Job. In this Heavyweight bout 42nd ranked El Diablo is defeated by a judges decision to the 12th ranked Slam Job.



WINTER 2001 CHAMPIONS OF THE NUT

SUPER HEAVYWEIGHT

BATTLEBOTS BULL MARKET

Team Inertia Labs was forged from the rusted steel and discarded parts of a forgotten Sausalito Junkyard. Alexander Rose, a classically trained industrial engineer, and Reason Bradley, a tried and true machinist, are the dynamic BattleBots duo. Alex and Reason have been the

**TEAM: INERTIA LABS
ROBOT : TORO**

#3 Ranked Super Heavyweight

Wins: 9

Losses: 2

KO's given: 4

Average KO Time: 00:59

Headquarters. As partners of Inertia Labs, Rose and Bradley now spearhead one of the most feared and prolific robot building teams in the country. One of their biggest supporters is Rich Rabkin, President of Rabkin & Associates, who has given the duo access to the company's vast machine and electronics surplus.

The brain trust of Inertia Labs has historically been responsible for creating powerful creations such as catapults and sail cars. But presently, fighting robots happens to be their bread and butter. One of many Inertia Labs robots would be the icon named Toro, the reigning BattleBots Super Heavyweight Champion. Sometimes the naming of a robot can be most difficult for a team. The name Toro, which means "Bull" in Spanish, came to Alex in a dream. Upon hearing this name Reason paused, then at the realization of the robot emulating the bucking action of a bull, had no problem accepting the new tag.

The powerful lifting ability of Toro comes from a distinct Inertia Labs design that involves pneumatics and levers. Understandably, Inertia Labs is reluctant to share this technology with the public. Not because they have a robot secret, but to stress that only qualified pneumatic specialists should attempt to construct such a system.

Rose and Bradley have discovered that repairing a robot is more difficult than to actually rebuild one from scratch. Often, the old robots will be retooled into practice bots for scrimmages with the newer inventions. Rose and Bradley do not give each other any allowances when scrimmaging against each other. We asked them who is the better of the two drivers? They agreed to disagree on this issue.

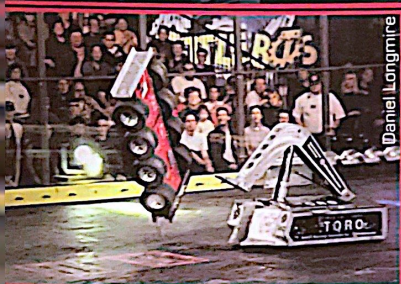
Inertia Labs is supported by a combination of cash and product sponsorship. Rose and Bradley place a high value on developing a collegial partnership with component developers. Under this arrangement, companies provide Inertia Labs with needed parts.

Through the development of their robots, Inertia Labs reciprocates by providing valuable consultation to the component developers on how to improve their products for use in the robotics community. Although, in the event a reputable corporation wishes to use Inertia Labs armor as a high

*Inertia Labs are
nuts about Toro
and that's no Bull!*

profile advertisement space, a monetary exchange is more than welcome.

As the success of Team Inertia Labs grows, the team is looking into possible expansion. In order to fulfill the team's desire to develop more combat robots, Reason and Alex may deploy a second team. What will happen if and when these life long friends go up against each other in battle? In light of their immense talents, this confrontation is bound to happen sooner or later.



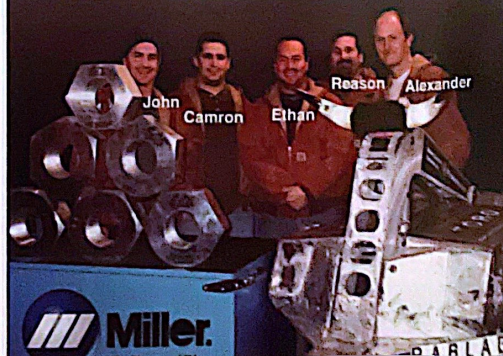
Runner-Up New Cruelty charged out of the blue square and engaged Toro with savage tenacity. With its eight wheels gripping the floor, its motors glowing with white hot intensity, New Cruelty used its I-Beam Weapon to good effect. However, Toro showed the true heart of a champion, weathering the blows and eventually taking command of this Championship Bout. Even in defeat, Richard Stuplich's New Cruelty managed to push its way to the #6 ranking in the Super Heavyweight Class.

best of friends since childhood. The pair started out by using parts from the old junkyard to create machines of metallic mayhem. With the unbridled encouragement of their fathers and a few trips to the flea market, the pair discovered that they shared similar talents for industrial design and heavy duty construction.

The old junkyard is all but gone now. However, in its place stands today's Inertia Labs

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PARLAB

HEAVYWEIGHT

THE ROBOT DON

Slowly but surely, the old guard of robots is finding out that they are unable to keep up with frenetic pace of today's robotic competition. One by one, they are being put out to pasture by the new vanguard of savage robots. However, the legendary BioHazard, one of the stalwarts of the old school, continues to dominate in his weight class. Newer robots continually try to topple BioHazard from his venerable position atop the Heavyweight food chain, but to no avail.

I recall the day the low profile mystery bot first entered the sport of Robotic Combat. Through the years, BioHazard has retained its very distinctive look, though it has gone through many stages of re-engineering.

The first incarnation of BioHazard arrived on the scene in 1996. The maximum weight limit at the time was 165 pounds. The robot was made almost entirely of magnesium to keep the weight down. BioHazard had a four wheel drive and four 17Ah batteries. BioHazard did not have anti-wedge fenders. In 1997, and went from four batteries to two batteries. The lower battery weight, coupled with an increase in the weight limit,

TEAM: BIOHAZARD
ROBOT: BIOHAZARD
#1 Ranked Heavyweight

enabled designer and driver Carlo Bertocchini to add the titanium fender skirts. BioHazard was also upgraded from a four-wheel to a six-wheel drive and its arm mechanism was fortified. In 1998 Carlo changed the front fenders to the design that he still uses today. In 1999, another increase in the BattleBots weight limit enabled the magnesium armor on BioHazard's top surface to be replaced with titanium. In 2000, the KillSaws were added to the BattleBox. This created a need for improved underside armor. In 2001, Carlo added extra armor to protect the linear actuator, and the drive motors were replaced with the first prototypes of the 3" Magmotor. As a result of these changes, the current BioHazard has very few components in common with the original 1996 version of the robot.

Bertocchini's key to surviving any robotic battle is a bulletproof drive system. Carlo designed the drive

Wins: 22
Losses: 3
KO's given: 10
Average KO Time: 01:45

train in BioHazard to be as strong as possible, while still staying within the BattleBots weight limit. Another key to Carlo's success is his Pit Crew. Today, the level of destruction has escalated to the point where constant repairs are necessary throughout any given BattleBots Tournament. In addition to Carlo's wife Carol, the pit crew includes David Andres and Rick Slagle. David is an electronics whiz. He is also pretty handy with a wrench. Rick is a mechanical engineer and is a veteran of many other robot competitions.

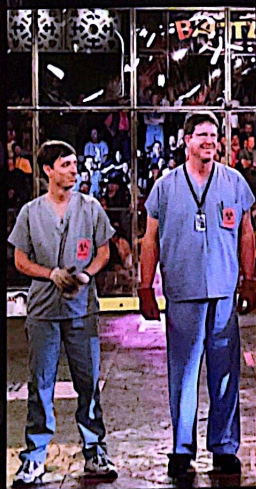
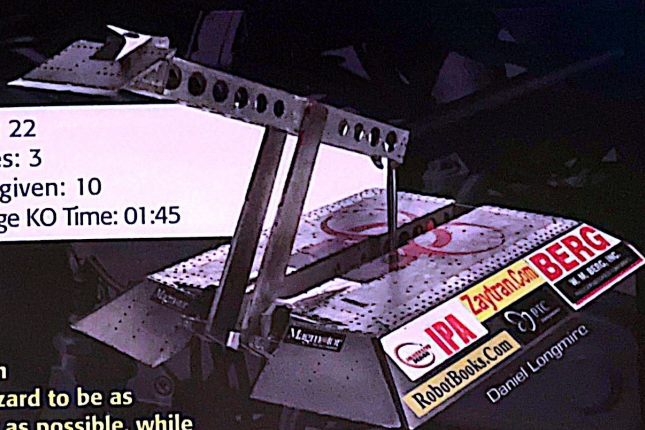
Only three robots have been able to defeat BioHazard during its career - Vlad the Impaler, Voltronic, and Son of Whyachi. BioHazard does not have to worry about S.O.W.

anymore because it was moved up to the Super Heavyweight class. Vlad the Impaler has effectively retired from the sport. Voltronic remains the only active robot to have ever defeated BioHazard.

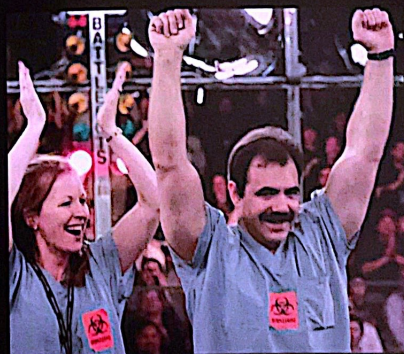
Nevertheless, Carlo is confident that BioHazard can continue as the King of the Heavyweight Hill. Currently, there are very few robots that have what it takes to take BioHazard down. It remains to be seen whether or not the new breed of robots is able to mount a serious challenge to BioHazard in the future. Stay tuned.

To find out more about Carlo and Team BioHazard, be sure to visit robotbooks.com, the one-stop shopping resource for Robot Books, Kits, and the popular Magmotor. You are bound to learn something...

Team BioHazard: From left to right. David Andres, Rick Slagle, Carol Bertocchini, and Team lead Carlo Bertocchini.



Daniel Longmire



Team Cool Robots' cutting edge technology once again hacked and slashed its way to the Championship Final. At the BattleBots Season 4.0 Tournament, Christian Carlberg's 4th ranked Overkill met up with former champion BioHazard. Twice before Overkill has fought Biohazard, with every match going the distance. This latest meeting was no different. The Judges result was a 27 to 18 victory for BioHazard.

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MIDDLEWEIGHT

CHAMPIONS OF THE NUT



TEAM: HAZARD
ROBOT: HAZARD

#1 Ranked Middleweight

Wins: 14
Losses: 0
KO's given: 14
Average KO Time: 01:13

Daniel Longmire

HAZARDOUS HAZARD

Tony Buchignani is the atypical BattleBots competitor. Many builders enter the sport of BattleBots with certifiable engineering expertise. It is not uncommon to find builders with specialized backgrounds in mathematics, physics, and the industrial arts. However, Tony has no specialized training in any of these areas. Tony is armed only with a degree in Psychology and Law. As unconventional as that may sound, Tony continues to dominate the competition with his Middleweight Champion Hazard. Tony's alter ego as an attorney only serves to add to his mystique.

Tony is no "guru" in the art of robot building. Nevertheless, he is able to use his skills of comparative analysis to excel as a builder. With simple trial and error, he is able to piece together his mechanized vehicle of destruction.

To this day, Tony does not use welding to piece his gladiator together. The frame of Hazard is machined aluminum, drilled, tapped, and torqued together with high strength bolts. The only change that Tony has made since last season is the replacement of the steel undercarriage and with an aluminum equivalent. This has reduced the weight of the robot by seven pounds. The weight was then shifted to an additional 3/4 inch in the armored walls of the chassis. Along with the modified undercarriage, Tony was able to integrate the lower bearing of the spinning propeller into the new aluminum section. This minor bearing adjustment allowed Hazard to lower the propeller impact point, making it nearly impossible for other robots to avoid Hazard's weapon. The \$5,000 Nickel Metal Hydride suitcase enables Hazard to pace the BattleBox floor at a steady 7 mph while powering three motors (Astro Cobalt 001)

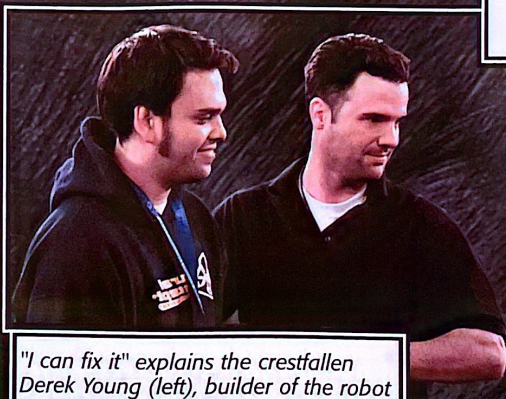
to spin its propeller weapon at an incredible 2000 rpm.

The face of a new competitor tells the recurring story of doubt, an identifiable insecurity which pleads for their robot to work. Tony Buchignani exudes confidence in the arena. He no longer hopes that his creation will work, he expects it to. Though Hazard is expected to perform without flaw, he did not foresee it doing as well as it did. Tony's confidence is very evident in his tournament demeanor, but Tony rarely talks up the destructiveness of his robots to competitors and pit watchers. The upgrades have turned Hazard into an unrelenting monster that effortlessly cuts, mauls, and destroys

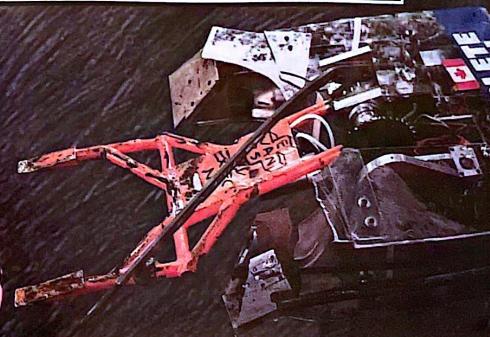
Moments of remorse and reverence are given from Team Hazard as they witness each opponent not only defeated, but disemboweled and shamelessly spread across the BattleBox. Team Hazard consists of Tony's father, Tony's wife Sara, and friend Adam Masri. The members of Team Hazard show true sportsmanship by helping to collect the remains of their opponents' robots after a bout. Until someone comes along to unseat Hazard, this will continue to be the case. With a perfect 10-0 record, Tony Buchignani's Hazard is the only undefeated BattleBots champion and will be THE BOT TO BEAT at the next BattleBots competition.

Robot: Complete Control
Runner-Up Winter 2001
#5 Ranked Middleweight

Daniel Longmire



"I can fix it" explains the crestfallen Derek Young (left), builder of the robot Complete Control. Tony Buchignani (right) looks on in triumph, as he has destroyed yet another thing of beauty.



opponents in its path. In the end it is Hazard that does the talking for Tony.

Tony explains that every match has a clearly defined strategy. Every robot is distinct and a different attack plan is required for each opponent. Tony taps into his skills as an attorney as he skillfully formulates strategies for each match. The event is inherently plagued with distractions. The lights, the cameras, and the crowd all contribute to the intense commotion of battle. In addition, the sheer adrenaline rushes of robot combat causes one to stray from even the best-laid plans. In the end, Tony's grit, determination, and experience as a BattleBots veteran enable him to be rampantly successful inside the Battle-

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LIGHTWEIGHT

TAKE THE CAT FOR A WOK

Seven years ago Jonathan Ridder watched his first Robotic Combat tournament. The spectacle opened his eyes and his brain churned on the possibilities; he was hooked forever. He began to think that he, himself, could "build a better mousetrap." To the chagrin of BattleBots lightweight builders everywhere, Jonathan built Ziggo, the answer to the proverbial "mousetrap". He claims the inspiration for Ziggo came from his own ill-tempered, claw wielding, saber toothed house cat, Ziggy.

Like most BattleBots veterans, Jonathan had a long list of failed robots before he built Ziggo. A lack of preparation caused a good deal of his earlier robotic creations to fail at inopportune moments. Discarding his chainsaws, cutoff blades and tracked drive efforts, Jonathan resorted to desperate measures. Retreating to the household kitchen, he began to seek out the ultimate weapon. "A meat cleaver?" you may ask. "A garlic press? Perhaps a preheated toaster oven." Nope. This is not the case with Mr. Ridder. Ziggo, the Terracotta Warrior was to be chiseled and helmeted with a Chinese Wok. Its hard to believe that the ominous spinning dome, which has laid countless robots to waste, was at one time only capable of cooking stir-fry vegetables. Many Martial Arts weapons started as simple gardening and farming tools, like the Nunchaku or the Kama. Perhaps one day the Wok will be sold exclusively as robotic weaponry.

Jonathan's welding expertise has enabled him to keep the same Wok shell throughout the years. The dome has increased its weight to about 25lbs, which is great for armor, but tends to cause an unwanted gyroscopic precession, or unbalanced spinning action. A less than balanced spinner will try and find a new axis of rotation, which may result in flipping and self-destruction. Jonathan's trick to keeping a well-balanced Wok is easy. After a serious BattleBot bout he retreats to the nearest tire shop. All it takes to balance the shell is a few weights and some high-strength epoxy. Just like the wheels on your car! The difficult part of the procedure is finding a mechanic that will allow the mounting of Chinese cookware onto his wheel-balancing computer.

Jonathan's pit crew includes his loving wife, Linda, and Doug Ridder, Jonathan's brother. Linda understands the long hours devoted to robot building. Jonathan boasts that his greatest accomplishments are his two children ages 1 and 2. Although not quite ready to join Team Ziggy, the little Ridders already show signs of carrying on the family legacy of robot building.



Historically Jonathan has had problems venting the heat from inside of Ziggo. Fortunately Ziggo is designed to last a full three minutes of battle before experiencing thermal catastrophes.

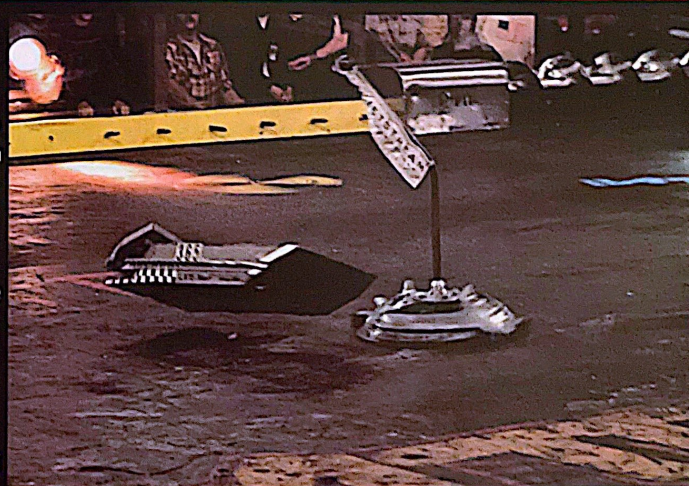
Ziggo the robot powers up with two Aveox brushless motors. The motors are run at 36 volts and spin the dome at speeds of 140 mile per hour. Jonathan, endorses Aveox, and is also an authorized dealer. Jonathan even offers his fellow robot builders up to 20% discount off the suggested retail price of Aveox motors. As for the future, Team Ziggy has introduced a middleweight contender named ZiggZagg. Jonathan is currently designing a Super Heavyweight similar to Ziggo. As for the Super Heavyweight weapon, lets just assume Jonathan has recently acquired and sudden interest in Mongolian Barbeque equipment!

TEAM: ZIGGY ROBOT: ZIGGO

#1 Ranked Lightweight

Wins: 18
Losses: 3
KO's given: 16
Average KO Time: 01:48

The Big B fought courageously against the heavily favored Ziggo. Undaunted, Big B continually attacked Ziggo's deadly spinning weapon. When the match ended in a virtual stalemate, Big B was the first robot since Defiant in 1999 to go the distance against Ziggo. Much to the audience's displeasure however, Big B lost the match on a Judges' decision. The narrow score line of 24 to 21 was a heartbreaking defeat for builder Gary Gin. Nevertheless, in his first tournament, Gary received the runner-up trophy and a #6 ranking in the lightweight division.





WINTER 2001 RUMBLE ROYALTY

SUPER HEAVYWEIGHT RUMBLE

Jascha Little's BattleBot is known as "The Judge" from Austin, Texas. Don't mess with Texas. The Judge laid down the law as its gavel pounded other Super Heavyweight

BattleBots into piles of tiny Lightweight BattleBots. This 9th ranked contender fights with style and grace, and it is only a matter of time before "The Judge" wins the Championship Nut.



Daniel Longmire

HEAVYWEIGHT RUMBLE



Daniel Longmire

Raise the Union Jack! Teams from the UK have consistently performed well in the New World. In 1999, an ace BattleBot appearance by Razor secured victory in the Heavyweight Rumble. Unable to stand up to the ferocity of a BattleBots tournament, Razor immediately retreated into BattleBots retirement. At Season 4.0, Ian Watts of Team Big Brother created a BattleBots sensation with his newest robot, Little Sister. Sporting a powerful lifting weapon, the smashing 18th ranked BattleBot turned many heads, as well as robots, and went on to win the Heavyweight Rumble. Ian Watts, an extraordinary builder, has no plans of cowering away with his win, and is expected to dominate at the next tournament.

MIDDLEWEIGHT RUMBLE

"Bad Attitude loves to rumble!!" explains 68-year-old Tom Pertruccelli the self-proclaimed oldest living BattleBot driver on Earth. Being solid, fast and powerful, this 7th ranked BattleBot is ideally suited for the mayhem of this free for all. Team Attitude's strategy is to crosscut the BattleBox at high speed. With the number of robots in the BattleBox, Bad Attitude is bound to strike something at full

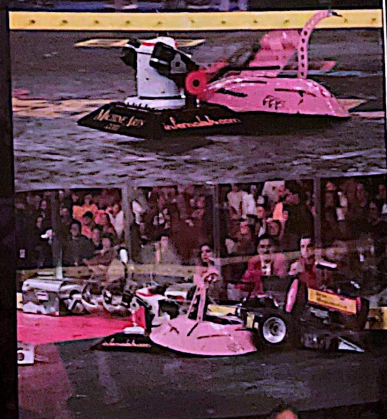
force. Once contracted to build BattleBots, today Tom and his wife Bonnie are taking great pleasure in competing with their own BattleBots.



Daniel Longmire

LIGHTWEIGHT RUMBLE

The Rumble is like pinball machine with the multi-ball activation. Flashing lights, crashing noises, and things rolling everywhere!" accounts Jason Dante Bardis, the leader of Team Infernolab. Jason points out to stay away from Ziggo and Backlash, or your rumble will end quickly. Jason also explains that the two key elements to winning a rumble are tactics and luck. The 5th ranked Dr. Inferno Jr.'s robust drive system and Jason's superior driving skills contributed to victory in the Lightweight Rumble at the Winter 2001 tournament.



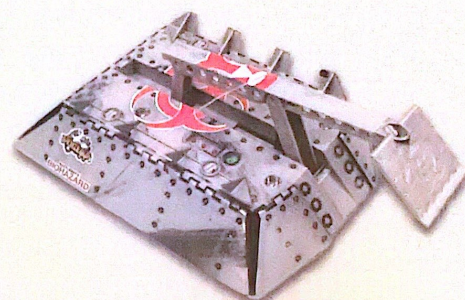
Daniel Longmire

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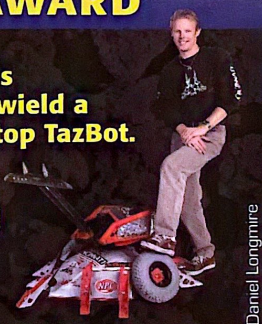


BEST OF SHOW



BEST DRIVER AWARD

Donald Hutson's driving skill is highlighted by his ability to wield a multi-weapon turret mounted atop TazBot. Aside from having to avoid the BattleBox hazards, Donald is able to maneuver his 5th ranked Heavyweight to strike at his opponents with an amazing array of weaponry.



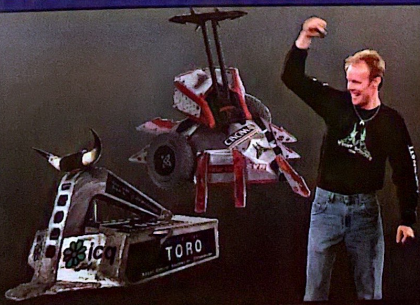
Daniel Longmire

Each Team in the BattleBots tournament is given the right to vote in each of the Best of Show Categories.

HERE ARE THE RESULTS FOR THE NOVEMBER 2001 TOURNAMENT

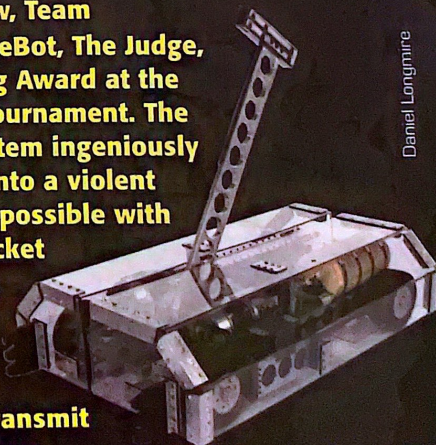
COOLEST ROBOT AWARD

Over four hundred (400) votes were cast in this category. When the votes were counted, the tally came as a mild shock. The Super Heavyweight Toro and Heavyweight TazBot ended up being tied for this honor. To this day, Reason Bradley, Alexander Rose (left), and Donald Hutson (right) are deliberating as to which half of the Nut they wish to take home.

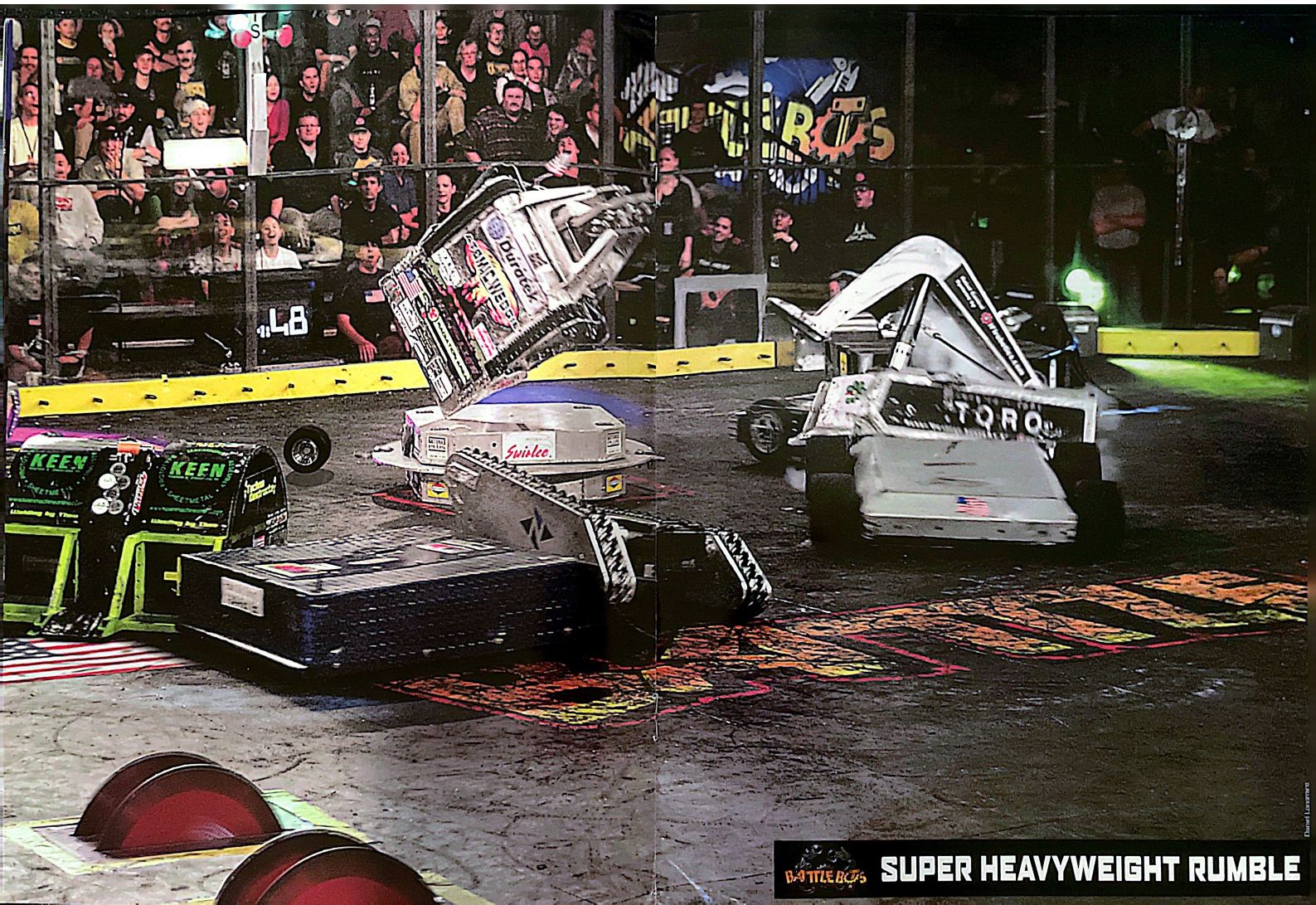


BEST ENGINEERING AWARD

For the second year in a row, Team Machicus' 9th ranked BattleBot, The Judge, received the Best Engineering Award at the BattleBots November 2001 Tournament. The high pressure pneumatic system ingeniously translates a linear actuator into a violent rotary motion. This is made possible with the use of a chain-over-sprocket version of a rack and pinion drive. With the bludgeoning power of a medieval mace, the surface impact of The Judge's gavel is enough to transmit violent shock waves of damage.



Daniel Longmire



BATTLEBOTS SUPER HEAVYWEIGHT RUMBLE

David Lawrence

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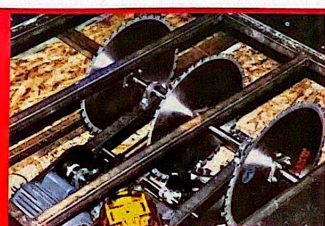


HISTORY OF THE KILLSAW

In 1998 Trey Roski, one of the creators of BattleBots, found himself at a local industrial tool dealer sizing up the various saw blade designs. He was looking for the perfect hazard while equipping his legendary Super Heavyweight BattleBot, Ginsu, with an assortment



of cutting tools. Trey ended up contacting the SystiMatic Division of International Knife & Saw and arranged for a shipment of stock Rescue Blades, specially designed to perform on gasoline powered demolition and rescue saws used by fire departments. The blades have chamfered tips to reduce saw damage and provide maximum strength to the cutting edge. It seemed like a perfect fit for the application at hand: slice up opponents and keep the contestants wary of hazards.



KillSaw emplacement 1999

BattleBots grew quickly and so did the saw requirements. SystiMatic custom bored the arbors to fit the motors powering the KillSaws and added more teeth to the blades to increase cutting potential and the aggressiveness of the saws. But there was one flaw in the design, the gullet, where the saw tips are mounted. The gullet was too wide and the saws were getting hung up on some of the larger robots.

For the third generation of KillSaws, BattleBots stepped it up a notch and requested a more aggressive saw blade with greater cutting power and fewer snags. Once again, SystiMatic answered the call. SystiMatic replaced the rescue blades with custom 20" HSR (Heat Stress Release) Gold Heavy Duty Metal Blades. These rugged utility

blades were the perfect choice for abusive and damage prone situations, such as stemming off the brutality of your average BattleBot. The unique, "controlled-chip" design meters and limits the amount of material that can be cut by each tooth, thus eliminating the snagging experienced with the rescue blades. HSR treating turns them gold and provides for a longer cutting life and greater durability. In addition, SystiMatic reduced the gullet size of the traditional stock saws and increased the tooth count, thus providing more cutting action with each turn of the blade. In fact, one of the first lightweights to encounter the new breed of Kill Saws was literally cut in half causing the motors driving the Kill Saws to be turned down a notch to prevent excessive damage.

BattleBots currently uses a modified version of the original Heavy Duty Metal Blades that features a reduced tooth count to calm the aggressiveness in the cut and two custom 19" Teflon Coated Kill Saws mounted to the exterior of each set. These Teflon Saws are laser cut, use aerospace grade teflon and have large, deep gullets. They are manufactured slightly smaller than the 20" HSR Gold Heavy Duty Metal Blades to "fling" robots across the arena, and they are positioned on the exterior of the Kill Saw box to add stability and protect the other blades from damage. SystiMatic pioneered Teflon coated design.

For several years now, SystiMatic/IKS has been improving the design of the KILL SAW and the fan's loud screams, hysterical laughs, and wide smiles show abundant approval of the destruction inflicted by the original arena hazard. The Product Specialists at SystiMatic/IKS, after four revisions and hundreds of custom saw blades, have finally designed the ultimate saw blade that is relentless in its "cutting" and savage in its "throwing". The refinement of the Kill Saw has added to the excitement of the competition and as long as they are around, it's Bots, beware!

- Jeramy Fisher
International Knife & Saw

MAKING THE TEAM

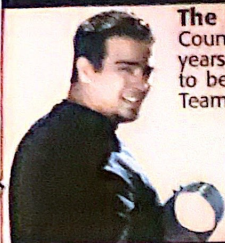
A LOOK AT THE BUILDERS BEHIND THE BOYS

FEATURING:

TEAM **LOKI**
ROBOTICS

The Driver- Julio Roqueta

Countless hours of driving every type of R/C vehicle invented and two years of competing on the U.S. FIRST circuit have made Julio very tough to beat. As the resident expert welder, machinist, and wheelman for Team Loki, Julio's skills are a true asset in and out of the BattleBox.



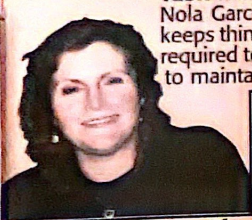
Founding Father - Korey Kline

Attending the 1999 Tournament as a spectator, Kline immediately started building Team Loki's first robot, Rammstein. Kline thrives on designing and building robots from scratch, while leaving the driving and repairing to other members of the Loki squad.



Task Master - Nola Garcia

Nola Garcia, the Operations and Production Manager, is the glue which keeps things together on the professional and personal levels. Sometimes required to pull the plug on mischievous behavior, Nola enables the team to maintain the proper focus and initiative for competition.



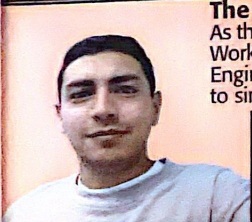
Researcher - Alex Espinosa

As the technical oracle, keeping Team Loki up to date with the latest elements used in building and maintaining BattleBots can be a full time job. Alex is best known as the first person to install an IFI controller in a BattleBot.



The Mouse Jockey - Eddy Ampuero

As the Computer Graphics Designer, Eddy uses a program called Solid Works to calculate component layouts and spatial analyses. Using Pro Engineer, Eddy is able to determine optimum structural integrity and to simulate damage scenarios before the robots are built.



The Analyst - Will Garcia

Known as the "repairman," this resident practical joker has the uncanny ability to conduct rapid pit repairs and post tournament upgrades. As a very methodical builder, Will records all activities in journal form for future reference and as a learning tool for others.



According to Nordic mythology, the word "Loki" stands for the trickster god or the spiritual mischief-maker. Team Loki is a fitting name for this fun-loving Florida bunch. Team Loki is not only a band of practical jokesters, but also a group of trusted colleagues and life long friends. Team Loki is a close-knit family of multicultural and multigenerational people.

The team commands an impressive fleet of seven BattleBots. Each Team member takes great pride in the areas in which they specialize. They all manage to pull together to accomplish tasks beyond their scopes of knowledge. Team Loki members have deep roots in the U.S. FIRST competitions. They also engage in community programs like StarBot, which

is a learning facility for young robot builders to apply their learned skills.

Team Loki Members not shown include:

Angel Palacios - The voice of reason during the highly charged electrical disputes.

Jose Montero - Using the CNC milling machine and the MasterCAM software, Jose machines the "impossible parts."

Bill Garcia - From logistics to logic, Bill's level headed mechanical and carpentry skills provide a valuable support element to the Team.

Mercy Rueda - Co-Designer of "Buddy Lee" with Nola Garcia, Mercy is one of the femme fatale of Team Loki.

BATTLEBOTS FOCUS

Mechanical mayhem makers destined to exchange metal in fierce form. BattleBots creates an arena, which quenches even the thirstiest of adrenaline-laden extremists. Robotic Combat presents an auge distending mechanical and electrical engineering spores, there is no doubt that inventions will find their inception here.

The sportsmanship between contestants is a true testament to the redeeming qualities of humankind, especially in these times. I observed many adversaries helping one another with parts, tools and pieces that eventually be used to fight each other. I was impressed by the wide array of people, ranging from the traditionally educated to the naturally endowed; each with their own brand of strategy and engineering. I had the privilege of getting to know some very bright and motivated competitors, their styles, and conceptual thoughts, and strategies.

As an extreme sports enthusiast, I was naturally drawn to the raw ingenuity and resourcefulness that individuals used to compete. Each bout would culminate to a single concentration of power; a power that seemed to have its roots dug deep into simplicity.

As a BattleBots Photographer, under the direction of Daniel Longmire, this was my first event. Still photography allows me to get close to the people of BattleBots. Eventually these contacts inspired a different perspective and the idea to write an article. I think my experiences as a skydiver, surfer, and a motorsports enthusiast, allowed me to really appreciate the BattleBots experience. I can't wait to film another action packed episode and see all the new weapons innovations, and teams.

-Marc Jourat
BattleBots Photographer

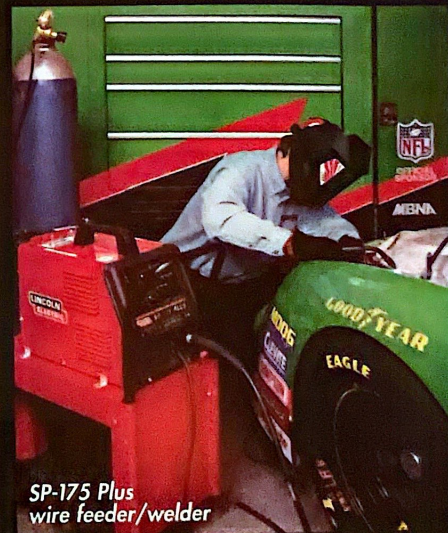


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The 4" Magmotor has seen action in champion robots like Minion and Nightmare, and the 3" Magmotor has powered BioHazard for over a year.

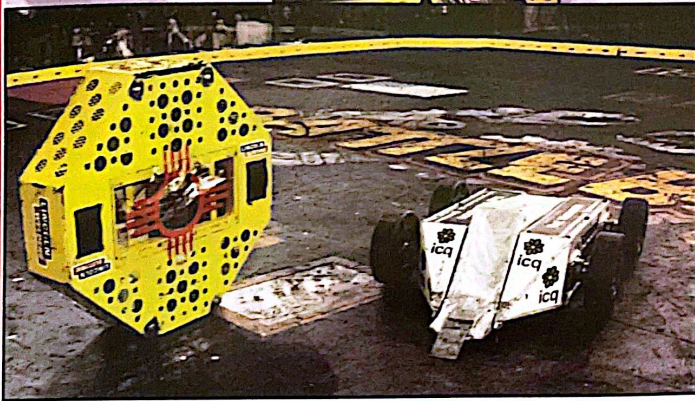
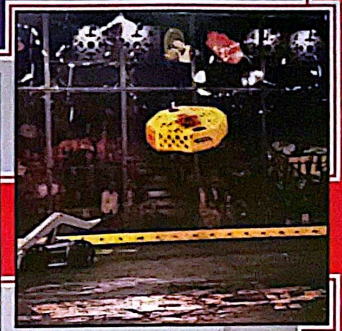
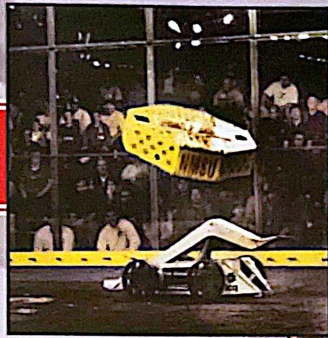
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NEW MEXICO STATE UNIVERSITY'S FLYING BOT PROTOTYPE



What goes up must come down. In the BattleBox, Robots seem to land on flat surfaces that have no wheels.

The octagon shaped BattleBot known as "Leper Messiah" entered the BattleBox with a top-secret anti-gravity generator. Swooping and diving in on its opponent, Leper Messiah plagued the heavily favored BattleBot Matador like a pesky housefly.

Unfortunately for Team Certain Death the anti-gravity machine is fiction. However, the Inertia Labs lifting weapon is a harsh reality. The Inertia Labs creation repeatedly flipped Leper Messiah into submission like pancakes at a greasy spoon.

Eric De Money (left) and Matt Marple (right) created Leper Messiah as a New Mexico State University Senior Year Project. With a squad of six students, two months, and limited funds, the team was able to come

up with the delightful rookie, and made quite a splash. Eric explains that the project was a great learning experience and that he is looking forward to returning to the BattleBox with an even better design. The Team known as Certain Death is far from it...

Members of Team Certain Death not shown include Jon Manuel, Eddie Patchett, and Joe McIntier.



Team Toad

lazytoad.com



If brute force isn't working,
You're not using enough!



There are many companies that provide Electronic Speed Controllers. BattleBots Magazine has selected a few to examine in detail.

HOW SPEED CONTROLLERS WORK

Electronic Speed Controllers, or ESC's for short, all do the same thing in general. They take a control signal - usually from a radio control receiver - and change how fast a motor spins. You could think of it like a dimmer switch for motor speed, but actually, that would be wrong.

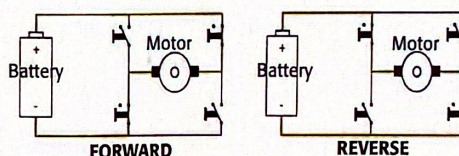
What a dimmer does for a light is choke off the amount of electricity flowing through a light bulb, making it dimmer. But what works for light bulbs doesn't work well for electric motors. If you don't give a motor enough electricity, it might not turn at all, but the electricity that still goes through it will make it hot, which isn't good for the motor.

The proper way to change the speed of a motor is to give it the full amount of electricity it is designed to run on, but to turn it on and off very quickly. Then, you can change the speed by changing how much of the time the current is on, and how much it is off. If it's on half the time and off half the time, then the motor will spin at half of its full power speed.

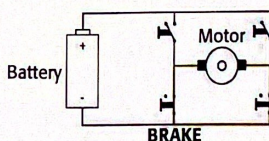
The way the Speed Controllers do this is with a special kind of transistor, called an FET, or Field Effect Transistor, which acts like an electronically controlled power switch. The Speed Controller flips these switches on and off very quickly, sometimes as fast as 2000 times a second, too fast for the motor to actually stop and start, so instead it just turns smoothly.

Another term you might hear Bot builders use is "H-Bridge". What this term refers to is an arrangement of switches that are used to change the direction a motor rotates. The name comes from the way this arrangement

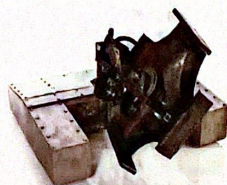
is usually drawn on a wiring diagram. Unlike batteries, for example, electric motors don't have a positive and a negative. If you swap the two wires, the motor just turns in the opposite direction. This is where those FET's come in again. The Speed Controller connects them so that each wire to the motor can be switched between either the positive or negative power line coming in to the speed controller, that way it can make the motor go forward and backwards at whatever speed you want.



There's one last trick that a Speed Controller can do. If you take the two wires from an electric motor and just connect them to each other, the motor becomes a lot harder to turn. A Speed Controller can use this effect to act like a brake to help stop the robot. Some of



the more expensive Speed Controllers can switch this on and off very fast as well, controlling how much brake you use. This is a very good thing to have when you're headed full speed towards the spike strip.



- Rich Chandler
Team Mouser
BattleBot Strike Terror

Robotic Sporting Good Motor Controllers

RSGMC & RSGMC Pro

Besides the motors, the speed controller(s) are the single most expensive part of a robot. The RSGMC Quick Start Dual Motor Controller (QS) was designed to make the sport more accessible to more people. A single RSGMC can control two motors and is fixed configured for either mixed (car-style) or non-mixed (tank-style) steering. The RSMC supports up to 24V @ 40A (continuous) and 150A (pulsed) per motor. It is available in a "bare bones" kit form to further reduce the cost. A person with experience handling and assembling electronic components can complete the kit in 2 - 3 hours.

The RSGMC Pro is physically identical to the RSGMC, but is user-configurable (car- or tank-steering). The user can also choose several signal-to-motor response curves based on the combat course. Connecting the controller to a PC and downloading the desired settings perform configuration.

The RSGMC's greatest strengths are its price and the information that comes with the kit version. Based on the user's skill and access to spare electronic parts, an assembled RSGMC Pro can cost between \$150-\$200. Not bad for a dual motor controller.

The Printed Circuit Board measures 7" x 6"; probably making it one of the largest controllers on the market. The reasons for its size are good.

The RSGMC uses all pin-through-hole components, which are larger than their surface mount counterparts. Because it is available as a kit, the extra room is necessary for fingers and eyes. And finally, the controller was designed in Texas, and everything is bigger in Texas.

Anyone considering the RSGMC should know that the controller has no case. It's completely bare, and the case was left as an exercise for the builder. You'll have to get one from your local Electronics Shop. If you are not comfortable working with electronic components, please purchase the assembled version. This kit is not for the "newbie".

RSGSC & RSGSS

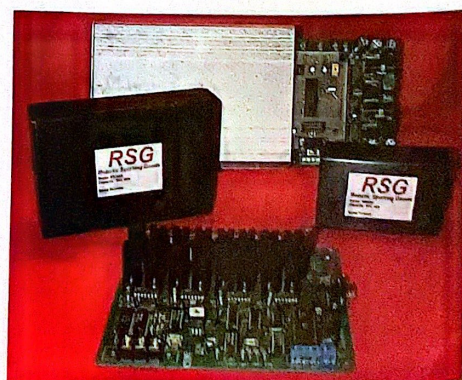
The RSGSC (single motor controller) and RSGSS (dual motor controller) are sold assembled and come in attractive extruded aluminum cases. These controllers are RSG's next generation. They use 12 MOSFETs per bridge as opposed to the more expensive MOSFETs (4 per bridge) used in the RSGMC. The controllers can handle up to 36V @ 50A (continuous) and 300A (pulsed) per motor.

The RSGMC, QS and Pro versions, and soon to be released RSGMX come with additional outputs. The RSGMC QS has a single open-collector output rated at 60V, 3A for turning on and off relays, flippers or valves. RSG's new controller, the RSGMX (scheduled for release in April) has a single open-collector output and a third full H-bridge rated at 55V, 3A for controlling a motorized weapon.

RSG Special Offer

Send in your used or broken speed controller of any make or model and receive a great discount on a new RSG model. Why are we doing this promotion? RSG is looking for serious competing builders. If you have previously bought a speed controller, you're probably serious and have a working (well, almost working) robot. RSG wants to help you get back in the battle and get our new controllers out. For more information, check out our web site at www.roboticsportinggoods.com.

- Winefred Washington



INERTIA LABS AND IFI

At Inertia labs, (creators of Toro, T-Minus and The Matador), we have used most of the speed controllers on the market. Early on we even went so far as to build our own speed controllers from scratch. The IFI Robotics speed controllers and robot control systems came onto the robotic combat scene in 2000 and we were among the first to try them in the arena and have used them ever since.

The designers of these components have a background in military components design tempered by years of competing and building products for high school robotics competitions. This translates into rugged, fool-proof electronic designs, and a company that knows how to produce and support them. One of the greatest benefits we have found in using IFI components in general is that they are always in stock and they send representatives, (usually the designers themselves,) to the events who have spares on hand and can help solve any problem you may have with their equipment. You can use these speed controllers either with the IFI control system or with hobby R/C systems, (the only difference is a special signal buffer cord used for the R/C systems). IFI speed controllers weigh only 4oz., are fan cooled, cost a fraction of what other controllers cost, and we have never had one fail in the arena. IFI uses a special coating on all the speed controller boards so that stray metal shavings etc. do not short them out, (a major cause of death in other speed controllers).

You will generally need one controller per motor which means if you want tank style steering you will need to 'mix' the input of two controllers to get single joystick control. Mixing between speed controllers can easily be done with a downloadable single stick program when using the IFI control system. Or if you are using IFI speed controllers with R/C type controls you can usually do the channel mixing in the radio with the "Flaperon" mix settings (for 'flying wing' style airplanes) or you can buy an external channel mixer from hobby suppliers. All the IFI speed controllers have a multicolor LED light which tells you if the controller is in neutral,

full forward or full reverse (very handy when testing). The controllers also have a calibration button which will allow you to set the ranges of the controller specifically to your system. The final feature on all IFI speed controllers is the dynamic brake function. By moving a jumper, the controller will brake the motor while in neutral. This gives you the option of having your motors coast to stop, or stop the moment you let go of the stick.

THE VICTOR:

The Victor 883 speed controller is rated very conservatively. While the Victor is rated for 60amps continuous, we have tortured it for extended spikes up to 200 amps. We use one per motor on Toro's motors, which draw 120 amps each during normal operation, and 180 amps at stall. We have NEVER blown an IFI speed controller in any of our three robots that use them. People have used a single Victor on multiple smaller motors (like the DeWalt drill motors) but we would not recommend this as it gives your system a single point of failure if a wheel gets jammed. Other contestants have used two Victor speed controllers on one four pole motor (examples include the NPC 1200, and 84088). This is accomplished by having each pole on the motor wired separately, thus allowing the connection of two Victor controllers independently. This is a very economical way to proportionally drive a high current motor.

THE THOR:

We used their new higher current version (120 amps continuous) called the Thor 883 at the BattleBots 4.0 event in our latest robot The Matador. These proved to be just as robust as the Victors as we had a completely stalled motor causing a nearly dead battery short and the Thor controllers are still in perfect condition. Other competitors also used two Thor controllers to power large four pole motors like the Magmotor at the 4.0 event.

THE VICTOR SC (Spin Controller):

IFI has also reworked the Victor and Thor into two new single direction weapon controllers that can handle almost twice the current of the Thor or Victor standard two directional models. This is achieved by reworking the controller so that both the forward and reverse components are now dedicated to a single direction. The weapon controller has three major benefits for a spinning robot or a spinning

IFI ROBOTICS.com



Thor 883

Victor 883

Victor SC (New Spin Controller!)

Victor HV (60v Available Soon!)



Warning: The following robots use IFI Motor Controllers and are highly reliable. Compete at your own risk!

Toro	Nightmare	Complete Control
Ziggo	Diesector	Techno Destructo
Tazbot	Hazard	Wedge of Doom
Frenzy	Trimangle	Surgeon General
T-Minus	Backlash	Little Drummer Boy
Turbo	Deadblow	Atomic Wedgie
Whirligig	Rammstein	and 1000's more ...



Over **13339** Sold

BREAKING DOWN THE BOT

EXCLUSIVE EXPOSURE ON THE BOTS TO BEAT

TEAM : Cat Bot ROBOT : Mouser Classic

#9 Ranked Lightweight

Wins: 7 Losses: 6
KO's Given: 3
Average KO Time: 02:51
First built in January 1997
Diameter : 32 inches
Height : 8 inches
Weight : 58 pounds



WEAPONS TEST!

Mouser's pneumatic spike tail easily pierces a 4x4 wooden block

Pneumatic 150psi CO² powered 1/4 inch sharpened steel tail spike - MEOWCH!

Two Dewalt 18 volt NiCad Batteries

Air regulator that feeds two electric valves

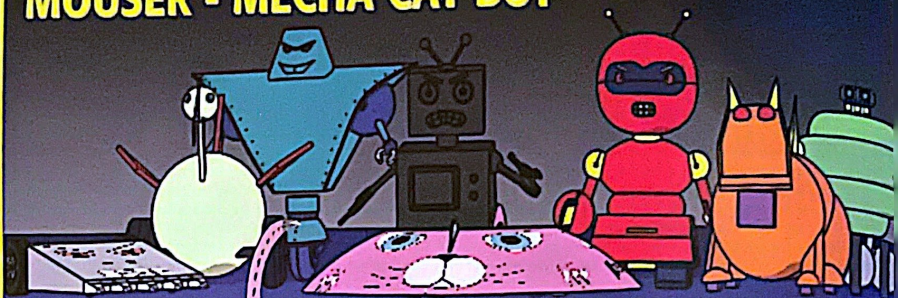
High traction hard rubber tires powered by two 12 volt Jensen Airplane starter motors.

Two CO² tanks each with a 20oz. 1000psi capacity

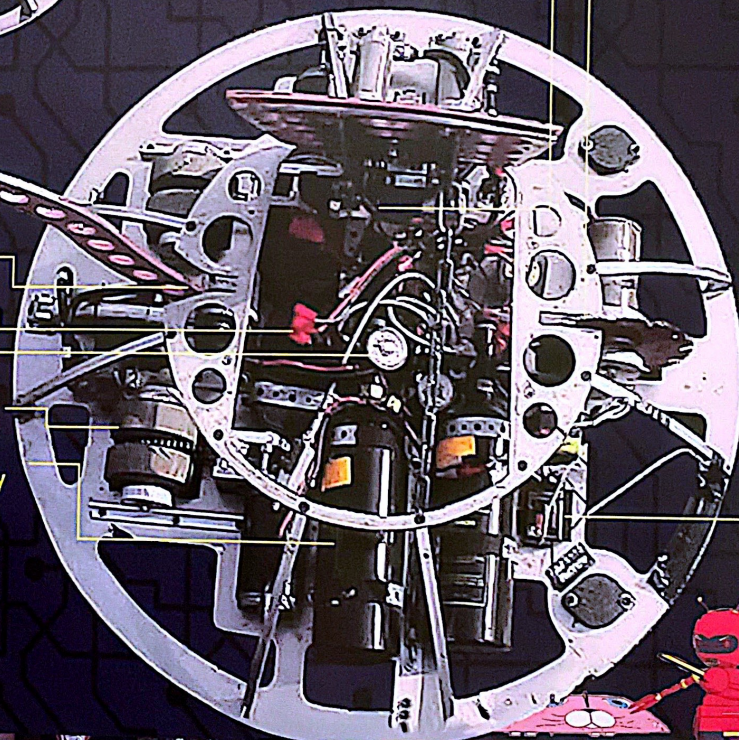
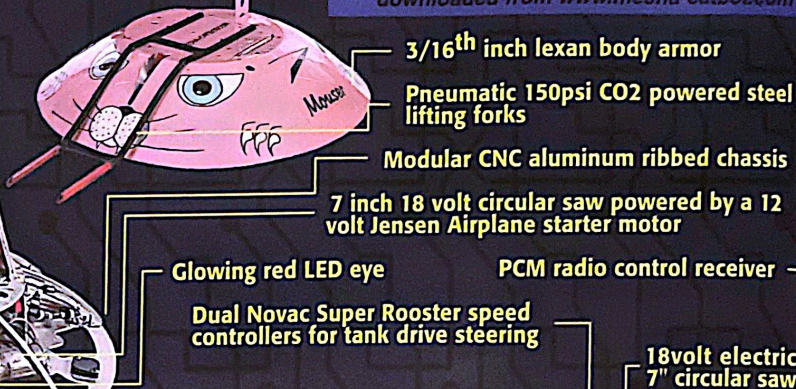
Custom modified transmitter with weapons control system

Team CatBot's favorite component is an in-house custom milled reduction sprocket used to increase torque on the drive train.

MOUSER - MECHA CAT BOT



Mouser music video cartoon can be downloaded from www.mecha-catbot.com



Fon Davis

Bonus Cavity Search

Lowell Nelson vents Half Gassed's armor and airs the components

Half Gassed a #46th ranked Super Heavyweight uses two electric drive motors and a gasoline engine for 0.5 horsepower of pushing force.

60-61-T6 1/4" Aluminum Frame

11"x7" GoCart Racing Tires

8hp Briggs & Stratton Engine
GoCart Differential at a 12to1 Reduction

10/1000amp 24volt
Duel Contactors

2 BOSCH GPA 750 24volt
Motors 12to1Chain Reduction

2 Powersonic 12volt
18amp Batteries

Team Delta
24volt H-Bridge

HiTec Radio
Receiver



Mouser Mecha-CatBot seems to have found a home in the Industrial Light and Magic Model Shop. When Team CatBot, April Mousley and Fon Davis, are not working on the next George Lucas extravaganza, they turn their model shop into a BattleBots Laboratory.

Mouser MECHA-CATBOT™

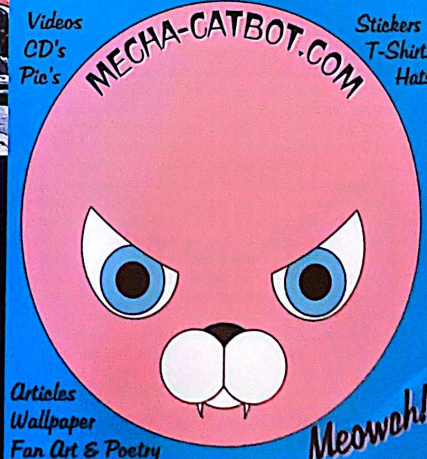
Videos
CD's
Pie's

Stickers
T-Shirts
Hats

MECHA-CATBOT.COM

Articles
Wallpaper
Fan Art & Poetry

Meowch!



(Inertia) from pg 23

weapon. The first benefit is a soft start-up. This will help conserve battery capacity since a motor is basically stalled at startup. The second benefit is the ability for a spinning robot to spin at a variable rate. This becomes very important if your robot becomes out of balance or unstable at full speed. This can be the difference between self-destructing (doing a Mauler) or being able to continue the match. The final and most important benefit is a special ramp down feature that takes over if you lose your control signal. When the signal is lost, or you turn off your transmitter, the controller softly ramps the dynamic braking from 0% to 100% over a ten second time period, then remains at 100% braking indefinitely (or until the control signal returns). This allows designers to make their spin weapons, or spin bots, spin faster and more freely than previously possible. The automatic proportional braking feature enables the robot to meet the two-minute spin down rule during inspection and competition. They have even built a special fail-safe into the controller so that if it loses power it automatically goes into 'shunt braking' mode to spin

down your weapon safely. The weapon controllers are under testing now and should be available in the spring of 2002.

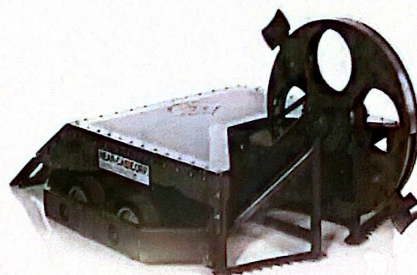
THE VICTOR HV (High Voltage): A high voltage version of the Victor 883 is under development and is scheduled to be available in the second quarter of 2002. The maximum voltage is targeted at 60v.

All the speed controllers have mounting holes for two #6 screws which is more than enough for a such a light device. They have fans that actively cool their power MOSFETs. The fans should be hooked up to the battery side terminals on the controller so that whenever the controller gets power, it is also getting cooling. When mounting the controllers you want to be sure there is adequate air flow and be very certain that no stray wires or hoses in your robot can come in contact with the fans and foul them. If you can shock mount the controllers it is recommended although we have been able to get away with hard mounting them for many competitions.



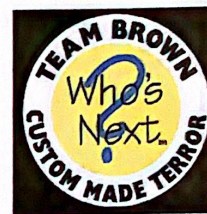
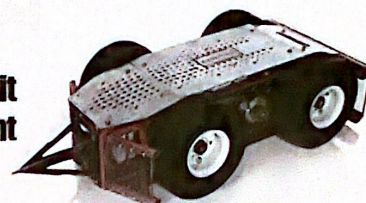
- Alexander Rose
Inertia Labs

We're not the best. But we're making good time!



**Greenspan
Heavy Weight**

**Jack Rabbit
Middle Weight**



www.teambrown6.com



Carefree Tire
FLAT-FREE GUARANTEED



THE VANTEC SOLUTION

The single most significant technical attribute of VANTEC controllers is the list of winners. Under that attribute are other qualities like the multiple MOSFETs properly secured to a massive heat conducting extrusion. For example: the steady current rating for continuous duty operation for the cumulative parallel MOSFETs of a single leg of the RDFR47E bridge is greater than 400 Amps yet VANTEC conservatively rates the '47E at 75A continuous duty. This is the reason the VANTEC units have such tremendous starting surge current capability over useful periods of time, not merely a few microseconds. High current equates to high starting torque for quick acceleration. The excess rating means you have a reasonable chance of

protecting the controller from a shorted motor by simple fusing.

In competition current limiting has proven to be a loser, not a winner. The guy willing to push it "just a little more" can be victorious. The RDFR21, 22, and 23's provide excellent current limiting for the cautious competitor. They feature a time element that reduces the current limiting as the controller heats up.

While the multiple paralleled assembly costs more to produce it has 5.76 square inches of thermal coupling from the transistors to the extruded aluminum case. This is more than twice the competition. Heat is the enemy of MOSFET devices because losses increase as temperature increases, and that further increases losses. This vicious thermal circle can lead to quick and final destruction. On

models with the "E" suffix the enclosure is a thick extrusion, which provides a true thermal conduction path to move the heat out and into your robot frame without the use of blowers or special heat sinks. The electrical wire, not the MOSFET H-bridge, is the current limiting factor.

The inductance in the whirling windings of a motor can generate some really nasty voltage spikes. The energy in these spikes is truly amazing until you consider that they are, after all, coming from a 3 HP motor! There is a lot of kinetic energy and it is not easily clamped. On the RDFR47E the transistors are 100 volt devices which allows the controller to operate up to 48VDC. Put another way this gives the controller more margin to simply "stand off" the motor spikes particularly when operated at the more usual 24-36 VDC.

As Battlebots take on more complex forms the steering geometry can get interesting. The RDFR series does the steering mixing algorithm internally. This lets you use a gyro for stability directly on the steering channel. The gyro stabilizes against opponent's blows as well as steering geometry problems. The units also have a generous selection of response curves to aid in taming steering response.

As competitors develop more sophisticated strategies using on-board computers the need for a computer commanded speed control grows. VANTEC offers the CDFR series for interface directly with 8 bit micros. Up to four distinct motors can be commanded with 8 bits plus a strobe.

- Dail DeVilleneuve
www.vantec.com

POWER MIG 200, POWER REBATE \$50

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AR01-14



The English controller manufacturer, 4QD Ltd., and its products, are the most valued by competitors who are looking for maximum reliability. Whether it is in England, or America, all of the Bot builders are aiming to get maximum performance during the short few minutes of the one on one combats and this is the main reason why many of them select the 4QD four quadrant speed controllers.

The outstanding reliability is the direct consequence of many years of continuous development effort based on demands meeting military standards using the state of the art MOSFET devices for very high response servo type applications with maximum power and heat management of the controllers. The four corner stones of this reliability are robust construction, maximum short circuit protection, simplicity and compactness.

4QD Ltd. has two 48V four quadrant H bridge controller families with the same attributes to high reliability with current ratings of up to 120A of the PRO/NCC series and 300A of the 4QD -300 series. Both of these families can operate for short periods exceeding the rated currents. The availability of the rated maximum current is governed by the heat management (suitable heatsink and heat transfer) of the controllers and as such, is available for minutes. The 4QD-300 unit is a completely self contained unit with its own heatsink while the PRO/NCC devices are designed to fit in small places and rely on the vehicle's structure for heat management.

The robust construction provides the resistance to sudden shocks and vibrations, which are the norm in the BattleBots confrontation of the fighting vehicles. All MOSFET devices and other components are selected based on their ability to operate in harsh physical environments and are securely mounted to survive high G forces. The power terminals, tracks and internal connections on the boards provide minimum resistance, hence heat and power losses are minimized.

The maximum short circuit protection is achieved by the proprietary circuit design based on very high response components which can sense and act, shutting down MOSFET power stages before the current build up would reach damaging proportions. This design technique allows the use of motors with extremely low internal resistance and inductance, such as the ironless devices built specifically for very high response applications.

The simplicity is evident with all 4QD controllers. They are modular, easy to handle and assemble for multi-axis systems. Each of the units has easily accessible means to customize the performance characteristics of the controllers. The compactness of the 4QD-300s means that the controller can operate to its full capability without additional heatsink in most applications and its mounting is not critical.

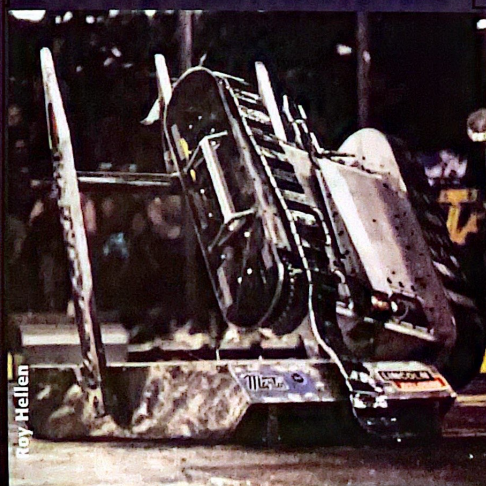
4QD Ltd. is continuously upgrading their speed controllers as newer and better components become available. The reliability of these devices is the major common factor of the company's success in the industrial and commercial markets and in the very competitive nature of BattleBots tournaments.

- Sandor Tako
sltako@aol.com

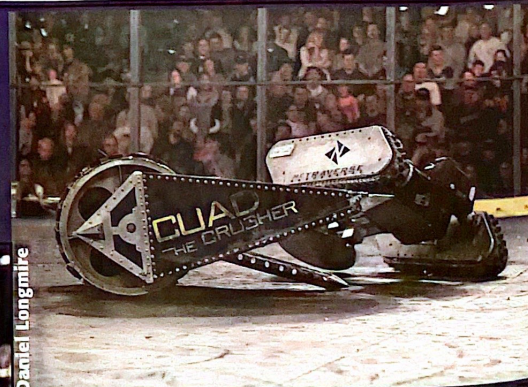
SLT TECHNOLOGY, Inc.

SLT Technology, Inc. is the representative and distributor of 4QD Ltd.'s product in the USA

Jeff Banks of Team Penetrators returned with his 21st ranked Super Heavyweight BattleBot Probe. With the grace of a preying mantis, Probe manages to remove the treads and to pluck the weapon from Phantom Thrust like the wings off a common housefly. This was Phantom Thrust's builder, Michael Kaweck's, first BattleBots Tournament. With skill and guile, Michael was able to propel Phantom Thrust to a 45th ranked position.



Roy Hellen



Daniel Longmire

CUAD The Crusher, the 26th ranked BattleBot, galloped across the arena floor for a classic bot joust with the veteran Ronin. The initial impact caused considerable damage to both contenders' drive mechanisms. The 18th ranked Ronin was able to twist its 14" diameter, 35 pound, horizontal disc weapon with 4 hardened S7 tool steel teeth into the chassis of CUAD The Crusher. Ronin was able to rack up some much needed Judges' Points. CUAD's colossal wedge fought back valiantly, but the Judges' decision of 25 to 20 awarded the match to Ronin.

INERTIA LABS TECHNICAL GUIDE FOR BOT BATTERIES

When designing your robot, batteries are often one of the most critical component decisions you can make. At Inertia Labs we have tried just about everything out there, and below you will find the most useful bits we have figured out.

Battery usage in combat robotics falls into two categories. Low voltage/ampereage batteries for powering radios, receivers and other low draw devices. And high voltage/ampereage batteries used in drive and weapon applications. (It is also possible to combine the two uses into a single battery solution with a voltage regulator or 'battery eliminator'.)

You can buy or assemble batteries in just about any size, weight, voltage, capacity and amp outputs. However as with any design problem, you must choose which of these key attributes you want, you don't get them all. Generally for batteries in combat robots the most critical trade-off is between sustained amp output and weight. I differentiate amp output vs capacity, or amp hours here, as amp hour capacity ratings turn out to be very misleading in combat robotics.

Your electric motor's horsepower or wattage equals your battery voltage times the amps your motor draws. If your battery set cannot put out enough sustained amps, or the voltage sags too heavily under load, you will not get the maximum power your motors can deliver. As you draw power from a battery the voltage will begin to sag, a 24v battery can easily sag all the way down to 11v under heavy load. The more amps you draw the more voltage sagging will occur, and the less efficient your motor becomes. Voltage sag is something few competitors take into account regarding their batteries but it is just as important as amp output in your horsepower equation.

Sealed Lead Acid (SLA):

These are batteries that have been developed for the communications, sport vehicle, and electric vehicle markets from the age old lead acid battery technology. These batteries can surge a ton of amps (often up to 1200), come in nice 12v packages and are often the heaviest battery solution. While they can peak the most amps for a split second, they cannot sustain high amp draw very well. It is also possible to make your own SLA packs out of 2v lead acid cells. This allows more versatility in battery configuration and voltage if needed. You will want a charger that is specifically designed for SLA batteries.

Nickel Cadmium (NiCad):

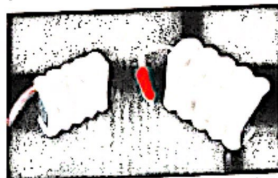
NiCad batteries are some of the most commonly used rechargeable batteries in electronic devices. Because of this there are many sizes, grades, and application specific NiCad solutions. These tend to come in 1.2v cells that have to be assembled in series into packs of a usable voltage. Next to SLA, NiCads have the second highest ampereage output, and are far better at sustaining high output than SLAs. The most commonly used size in robots is the sub C cell size and the full C cell size. The good ones range in capacity from 2.4Ah to 3.6Ah and can put out bursts of up to 200 amps and hold 80 amps of output for a couple minutes. To charge them you will need a charger designed for NiCads and the number of cells in your pack.

Nickel Metal Hydride (NiMH):

NiMH batteries are now often seen in portable phones and computers and as loose rechargeable cells. They come in the same cell sizes as NiCads but are generally lighter and cannot put out as many amps. These are also easier on the environment when it comes time for disposal. The chargers are usually identical to the NiCad chargers but you often charge them at a slightly slower rate.

Lithium Ion (LiOn):

LiOn batteries are rarely used in combat robots. They are one of the more recent commercially available technologies which has been primarily developed for very low ampereage devices. They are the lightest of the types discussed here and put out the least amps. They also require specialized chargers. These are mostly useful for radio batteries or in very high voltage drive and weapon applications that don't require too many amps.



Small 12v packs made with AA and AAA cells

Low Draw Applications:

(under 12v, and under 2 amps)
For receivers, radios and other low draw applications it is possible to use very light batteries. To power our 12v IFI radio which draws less than one amp at 12v we use a series of 10 "AAA" NiMH cells to form a pack that will power our radio for an hour or more of constant on time and weighs only a few ounces. You can also get these packs in 4 cells to power standard RC type receivers. For draws this low it is

conceivable to use LiOn batteries, but you will need a special charger and the weight savings on such a small pack is minimal for the trouble and cost.

It is also possible to use a voltage regulator on your main battery system to power your radio and other low power items, but we have found some disadvantages to it. When super high loads go on your main batteries the voltage drops heavily. Depending on how severe this is, it can cause your radio to shut off intermittently as these large voltage dips occur. Since it can be done for a low cost in weight, we have found a separate pack is often a better route. (It is also worth mentioning that you could use disposable alkaline or lithium batteries for these types of applications which may last the longest but its expensive, wasteful, and wont save any weight.)



20 cell 24v pack made with C cells

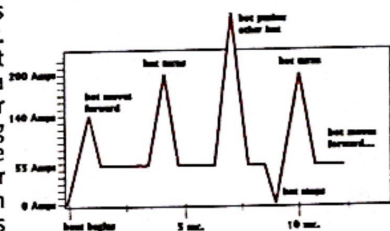
High Draw Applications:

(12-48v and 50 to 1000+ amps)
These are your main batteries. The voltage and ampereage you need will depend on your motors, gear reduction and the ability of external forces to stall the motors.

One of the most common confusions about batteries in combat robotics is around the Amp Hour ratings most manufacturers use to rate the capacity of their batteries. The problem is that this rating is heavily dependent on how many amps you are trying to get from the battery and the battery type. For instance an SLA battery system rated for 18 Ah will only put out a tiny fraction of that when being loaded at several hundred amps for a few minutes. It is often very difficult to get ratings on batteries for 3 to 5 minute total run times, and so we are often left to experimentation. Batteries also tend to get very hot when used this way. We use temperature "tell tale" stickers that tell us how hot batteries and other parts of the robot get during practice and competition which are very helpful.

What is critical to robot builders is finding a battery that can put out the surges of power needed to get a powerful DC motor running and then sustain a portion of that for the whole 3 minute bout with

continual spikes of demand for turning and pushing. In the graph below you can see what kinds of demands might be put on a set of batteries in a modest 24v drive system during the first ten seconds of a bout. This bot draws about 55 amps nominally when moving but since it has to overcome a lot of tire friction when it turns or pushes against something, it has peak demands well above 200 amps. You can also see that the demand peaks when the motors start moving from a stand still.



The usage curve for weapon motors is also similar as it takes a certain amount of power to get a spinning disk up to speed, but once its spinning it uses a nominal amount of current, which is interrupted by spikes of demand every time the weapon meets resistance (like the other robot).

So how do you decide which batteries are for you? As you can see there are a lot of factors. Since it is impossible to understand every situation I will go through our battery decisions with our robot Toro and hopefully you can apply the same logic to your robot and just scale the numbers appropriately to make your choice. In Toro, a 340 pound super heavy weight robot, we use four 24v motors that draw 180 amps at near stall. (Most places selling motors for robots like NPC, can give you the stall current for your motors. Otherwise you can use an ammeter to find your motor draw.) Our total potential draw could be over 700 amps in our drive train if all the motors stalled (not very likely). We geared these 3000 rpm motors at about 7 to 1 and used wheels of about 11 inch diameter. This gives Toro a top speed of about 13 m.p.h. while still having enough torque to spin the wheels when pushing against something. (This slippage is important as it means our motors rarely draw their full stall current which helps our battery life and speed controllers.)

We originally put two 12v Lifeline SLA 18Ah batteries in series to get 24v. These weigh about 31 pounds combined. The Lifelines gave us really good power for the first minute or so. (They could surge up to 1200 amps) but after 2 minutes the robot was very sluggish and at 3-5 minutes of

WWW.

BattlePack

.com

BattlePack hand built batteries powered Toro to super heavy weight victory. BattlePacks are used in the most successful robots in the sport for their quality, amp output, and support.

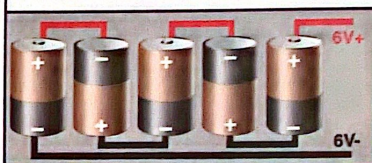
Look who else is using BattlePacks:

- T-Minus
- Dr. Inferno Jr.
- Jack Rabbit 2925
- Complete Control
- Heavy Metal Noise
- Techno Destructo



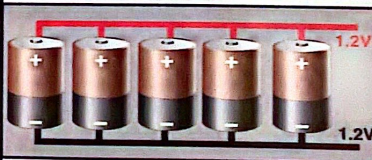
check out www.battlepack.com or call Steve Hill at (502)-732-0316

hard driving the robot barely moved. We then went to two 12v Hawker Genesis 16Ah batteries because they were a few pounds lighter and we had heard such good things about them from other builders. These turned out to give us even less run time than the Lifelines (With nearly the same chemistry, the 2 less amp hours really did matter in this case.) Then we put in six 3Ah NiCad BattlePacks in parallel which weighed only 24 pounds. The additive amp hour rating was again 18 Ah, but the NiCad battery chemistry, and the parallel configuration work in our favor to sustain current for much longer. Toro now has over 10 minutes of run time while still saving 5-7 pounds and taking up less space than SLA batteries.



Series

The diagram above shows 1.2 volt cells in series, notice how the cells are connected positive to negative to make their voltages additive (6v total). This battery pack, if built with 3Ah cells which can put out 80 amps each, would result in a battery of the same Ah rating and amp output rating. So in series construction voltage is additive but not Ah or total amp output.



Parallel

The diagram above shows 1.2 volt cells in parallel, notice how the cells are connected positive to positive and negative to negative which makes their voltages stay the same (1.2v total). This battery pack, if built with 3Ah cells which can put out 80 amps each, would result in a battery of 18Ah rating and 480amp output rating. So in parallel construction voltage stays the same but Ah and total amp output is additive.

Whole battery packs can be put in series or parallel as well having the same additive effects to voltage or amp output. Some battery pack makers also offer 'cell matching' and 'cell zapping' or 'voltage enhancing'. It is our experience that cell matching does not make a huge difference since we are putting many packs in parallel and to match all the cells and the packs would be near impossible. Also we don't use the cells to the end of the packs life where matching becomes critical. Zapping or Voltage Enhancing however does seem to decrease

internal resistance in cells making them able to put out more amps slightly longer.

Charging and Care:

Charging for each type of battery is a bit different. One of the best ways to ensure good care for your batteries is with a log. Many chargers tell you how many amp hours and what the peak voltage was when charged. By keeping track of this and other factors like run time, and total number of charge cycles you will quickly see how to get the best performance out of your batteries.

SLA batteries need to be charged with specific chargers made for their chemistry. Not all SLA batteries are the same. Some use Absorbed Glass Mat (AGM) and or Spiral cells which require special charging. Most good charger manufacturers like ChargeTek and Guest have chargers made specifically for these high performance SLA batteries and you should talk to them about your batteries when ordering. SLA batteries should generally be stored with a full charge or with a battery maintainer on them as if left uncharged for extended periods they will be ruined.

NiCad and NiMh batteries generally use 'peak charging'. This means that you charge them with increasing voltage until it peaks and then stop. Most good chargers take care of all this for you. You will need a charger that can handle the number of cells in your packs. Most hobby chargers are only designed for 6-9 cells making a 20 cell 24v pack out of its range. The most used charger in combat robotics for NiCad and NiMh is the Astroflight which can charge up to 40 cell packs. There are several other manufacturers currently developing chargers for more cells too. Periodically it is wise to fully discharge these packs to minimize 'memory' effects. These batteries should generally be stored in a mostly discharged state.

LiOn Batteries require a special charger, contact your vendor for more specifics.

Inertia Labs Battery Recommendations :

All batteries are not created equal. Below are recommendations on brands. It should be noted that whichever type of battery you use there are very few that will work in a combat robot due to high performance requirements. If you don't use any of the ones listed below be sure you talk to your vendor extensively about the application before the purchase.

BattlePacks: Inertia Labs co-developed these with Steve Hill who had been building packs for RC boat and plane industry. After

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calling many suppliers and talking to them we found that few to none understood the rigors of combat robotics. Working closely with Steve we have evolved BattlePacks and continue to improve them every competition. We feel that they currently offer the best power to weight ratio out there and can handle the most abuse. These packs are hand built with materials and processes that allow them to handle the high heat of fast discharge and the general rough environment of combat robots. We design all our robots around them and have even recently retrofitted Toro to use them which more than doubled its run time from the Hawkers it used to use and saved over 5 pounds. The only real charger solution we have found for these is the AstroFlight 112D which works great but requires a separate power supply. Astroflight and Steve Hill are working on better chargers for combat robotics.

Hawker Genesis: These are one of the most popular Sealed Lead Acid (SLA) batteries in combat robotics. They make individual 2v cells that you can make packs from (in fact Steve Hill can make these for you too). They also make many 12v battery sizes. Hawkers are able to put out a lot of cranking amps making them great for high amp weapon motors (and some very large drive systems) but we have found that NiCad BattlePacks are better for most drive applications. The best SLA chargers out there are from ChargeTek. Their chargers, like the ChargeTek 2000, can charge up to three 12v SLA batteries at 20 amps each, even when they are hooked up in a 24v or 36v system. This makes charging a lot easier.

Lifeline: These are a great SLA battery that I think our team is the only one to have used. They make an 18AH battery that can put out 1200 amps (the GPL 1300) which we used in the first version of Toro, these outperformed the Hawkers we tried later. Again the best SLA chargers out there are from ChargeTek.

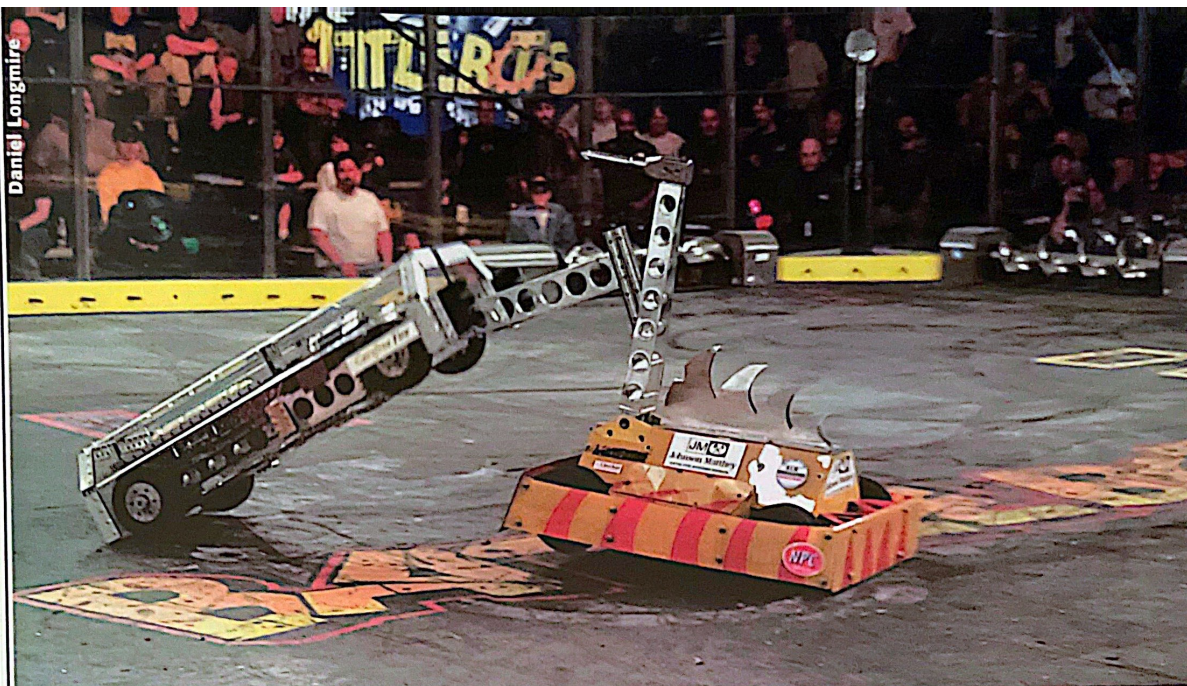
Panasonic SLA: We used to use these in Rhino and they are pretty good. They have many sizes and ratings to choose from. Again the best SLA chargers out there are from ChargeTek.

Eagle Pitcher: Is the only LiOn vender we know of that builds LiOn packs for combat robotics.

- Alexander Rose
Inertial Labs

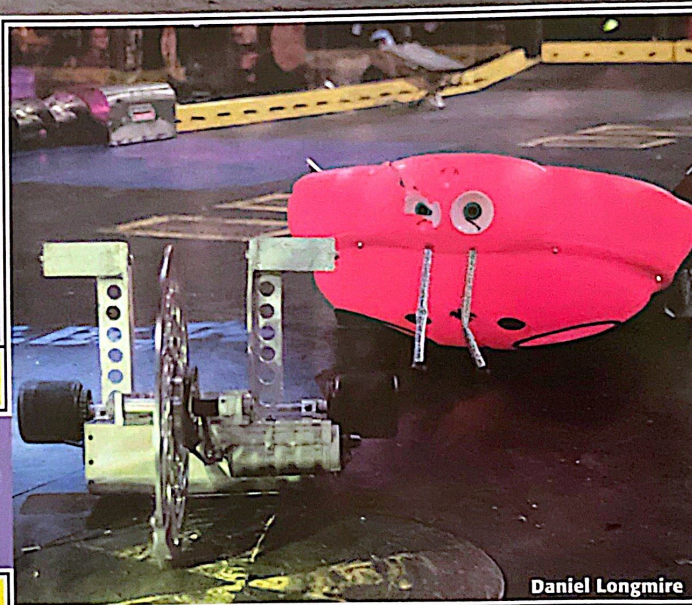


Daniel Longmire



The Judge (left) and Hammertime (right) are two of the hardest hitting Super Heavyweight BattleBots on the circuit today. Standing toe to toe the two titans exchange blows like possessed pile drivers. The Judge's Gavel brought order to the match with a deadening crush to the 27th ranked Hammertime.

10th ranked Tentoumushi (right) takes time during the Lightweight Rumble to show 2nd ranked Backlash (left) how to assume the "Dead Bug" position.



Daniel Longmire

+ Ah....Battery Capacity -

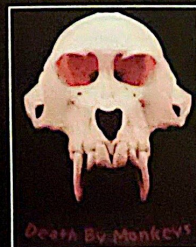
My favorite method for figuring out how much battery capacity (Ah) you need is to determine how many amps you need to spin your bot's wheels when pushing against a wall (a push test). There are several steps to this.

1. Figure out how much torque each motor needs to deliver in a push test. A common heavyweight (220lb) configuration has 4 NPC 64038 motors, with each driving a single 10" diameter wheel. This means each motor is pushing $(220/4) = 55$ pounds. Multiply this number by the radius of your wheels to get the torque required for the push test $(55 \times 5) = 275$ in-lb, this is your torque.

2. Determine how many amps your motors will draw in your push test. Some motor suppliers such as NPC and AstroFlight provide you with the amps drawn at given torque levels on their web pages. The NPC Robotics web site shows that a NPC 64038 motor draws approximately 40amps when producing 275 in-lb of torque. With 4 motors, this means we'll need $(4 \times 40) = 160$

amps. If you can't get this information from your motor suppliers, you can figure it out if you know the torque constant (Kt) of your motor. If you are interested in doing this, Bob Boucher's Electric Motor Handbook explains the calculations in more detail.

3. Next, determine how many amp hours of energy your bot will use during a 3 minute match and a 5 minute rumble. The Ah needed will be a fraction of your push test amps since 3 minutes is 1/20th of an hour. In our example this is $(160/20) = 8$ ah. If you want to plan for a rumble, you'll need 1/12th of an hour, $(160/12)$ or 13.3ah. It is unlikely your bot will ever draw 160amps for a full match so many people will take a percentage of the ah needed to determine their battery capacity needs. In extreme pushing matches we've used up to 75% of our calculated capacity. Non-pushers or rammers will require less. To be on the safe side we assume we'll need 100% of our calculated capacity.

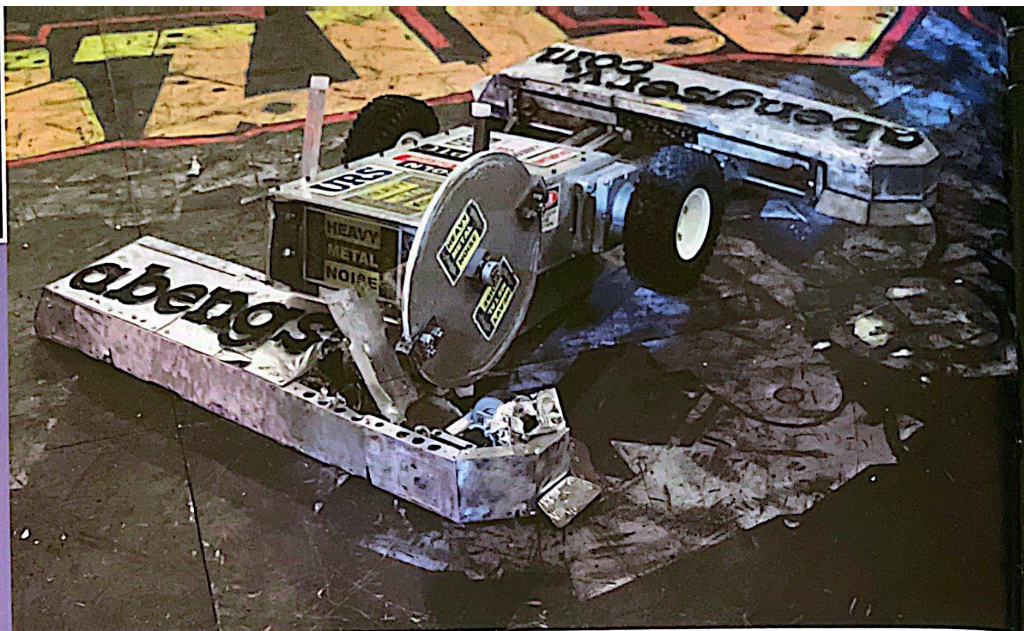


-Robert Farrow
Team Death By Monkeys

BOT SHOTS

Daniel Longmire - Marc Jourat

Hheavy Metal Noise was all but doomed when it was pinned by the crushing weapon of Huggy Bear. As Huggy Bear clamped down on the hapless Heavy Metal Noise, the tide of the match suddenly turned. The spinning disk of Heavy Metal Noise managed to catch the side of Huggy Bear, ripping into Huggy Bear's armor. This disabled Huggy Bear's electrical system and destroyed the air tanks that power Huggy Bear's Pneumatic crushing weapon. Huggy Bear sighed out it's last breath of compressed air and died. Heavy Metal Noise had achieved a most unlikely knock out victory.

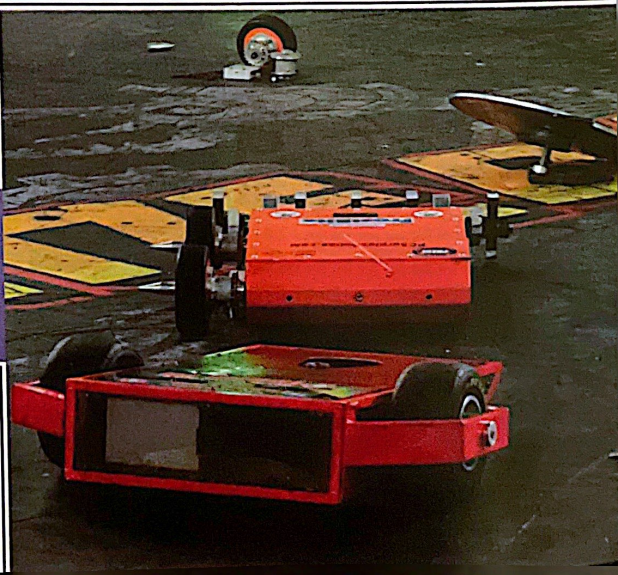


At the first Treasure Island Tournament, Little Drummer Boy was able to humiliate Bouncing Betty with a vicious and public dismantling. In one of the most anticipated grudge matches of 2001, Bouncing Betty returned to the BattleBox with revenge in her heart. After a long grueling match, the underdog Bouncing Betty knocked Little Drummer Boy on its back like a stranded turtle. As the match clock ran out, Little Drummer Boy, last season's runner-up, was barely saved by the bell. Nevertheless, Bouncing Betty won the fight, getting her sweet revenge on Little Drummer Boy.



Junkyard Offspring received a crushing blow on the nose from Nightmare's powerful blade. This separated Junkyard Offspring from his own receiving unit. It also twisted the metal around Junkyard Offspring's weapon, causing it to seize. Unable to receive commands from driver Anthony Elder, Junkyard Offspring continued to apply full power to the damaged motors, creating some very expensive smoke signals. Two out of the five motors had been destroyed. Mortally injured, Junkyard Offspring was eventually counted out.

Frostbite and Surgeon General work together to setup a BattleBox Yard Sale.



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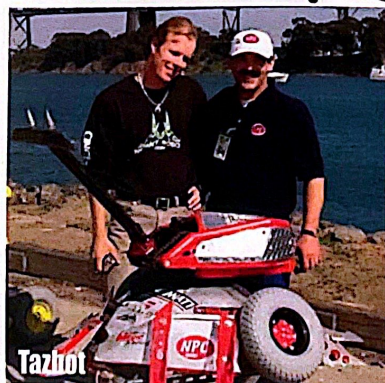
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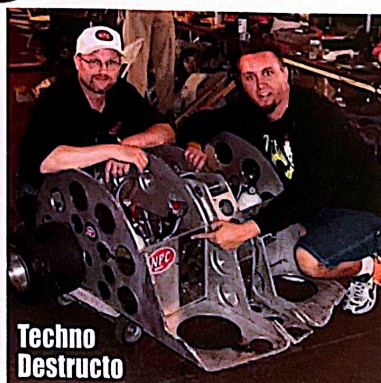
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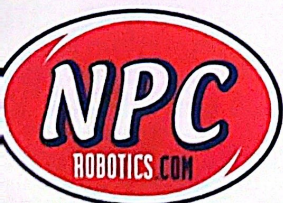
Tazbot



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